VOLUME 4

ARCHAEOLOGY OF THE MAYA

An Archaeological Reconstruction of Ancient Maya Life at Pacbitun, Belize

EDITED BY

TERRY G. POWIS,
SHELDON SKAGGS AND
GEORGE J. MICHELETTI

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FOREWORD BY JAIME J. AWE

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COVER IMAGE *Anthropomorphic `grotesque figure' vessel flute from EC-Burial-2, the North Group of the Eastern Court at Pacbitun.*

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To Paul F. Healy – For All of the Blood, Sweat, and Beers

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Foreword

In the spring of 1986, having recently started the graduate program at SUNY, Albany, I received a letter from Paul Healy offering me the position of Assistant Director to a project he was about to launch at Pacbitun, Belize. The offer to join in Paul's new project was in many ways a continuation of a long, successful, and very productive research partnership that had been fostered since our first meeting in 1977. Needless to say, I immediately accepted Paul's invitation, and three months later, I was once again driving our project's pickup truck from Peterborough, Ontario to San Ignacio, Belize.

In so many ways, this first Pacbitun Project can be credited for several diverse successes and accomplishments. First, and what I personally consider as foremost, is the project's substantial contribution to the development of Belize's archaeological human resources. It was at Pacbitun, for example, that Winnel Branche, Allan Moore, John Morris, Alfredo (Jim) Puc, and Javier Mai either began or continued their training in archaeological field methods. Winnel, Allan, John, and I eventually became heads of Belize's Department, or more recently the Institute, of Archaeology, where some of us continue to work in the management of the country's tangible cultural resources. Jim Puc and Javier Mai likewise continue to work in heritage management at the Actun Tunichil Muknal and Offering Cave archaeological parks.

The first Pabitun Project also served as training ground for many now established archaeologists and scholars. These include colleagues such as Gary Copeland, Joel Boriek, Cassandra Bill, Kitty Emery, Lori Wright, Polydora Baker, Melissa Campbell, Beverly Morrison, Clarence Ritchie, and Richard Garvin. Through the collaborative work of all these individuals, and under the direction of Paul, we were not just able to place Pacbitun on the archaeological map of western Belize, but also to establish the site as a major regional player in the political landscape of the Belize River valley. This early foundation has been expanded and enhanced considerably by Terry Powis and his colleagues whose important contributions to the significance of Pacbitun are professionally presented in this volume. It is also refreshing to see that Terry has continued Paul's and my tradition of collaborative research by investing in the training, mentoring, and development of younger colleagues. The diversity of papers in this volume are clear testimony of this tradition, and of the value of integrating a holistic approach to scientific enquiry.

Other commendable successes of both Pacbitun Projects are evident in their contributions to our knowledge of the Preclassic Maya, to our study of ancient Maya agriculture, settlement systems, and economic specialization, on the function and meaning of monumental architecture, and on the socio-political relationship between Caracol and sites in the Belize Valley.

In closing, I would also like to recognize several Belizean colleagues who have passed to the great beyond, but whose participation in the research at Pacbitun resulted with significant contributions to our knowledge of the site. These colleagues include Don Valentin Cu, who served as foreman of the first project, Ventura (Tigre) Chi, Gumercindo Mai, Ireno Magana, and Gustavo Manzanero. In so many ways, the information produced in this and other volumes on the Maya are only made possible because of their hospitality, their collaboration, and their shared interest to learn of the amazing achievements of their ancestors. This present volume on Pacbitun is truly a reflection of the collaborative approach that is embraced by those of us who conduct research in western Belize, and that has always been a major part of the Pacbitun Project since its inception in 1986.

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1

Introduction to the Archaeology of Pacbitun

Terry G. Powis, Sheldon Skaggs, and George J. Micheletti

Archaeological investigations over the past four decades have provided significant insight into the rise and fall of the ancient Maya centre of Pacbitun. In the course of these investigations, a number of questions about the founding of Pacbitun and the subsequent politics and daily activities of the people have driven the most recent research at the site. Located to the south and east of the sites that compose the Belize Valley region in west central Belize, Pacbitun sits isolated, tucked into the foothills of the Maya Mountains (Figure 1.1). Just to the north are lands much richer in terms of arable soils and water sources for maize farming. Alternatively, Pacbitun's surrounding area provides its inhabitants access to resources not found in the Belize Valley. These resources included pine trees, slate, and granite to name a few. It is not known whether the site was initially settled for resource exploitation, or for other reasons such as access to the numerous caves and springs located in the area. What is certain is that the site thrived economically and endured politically for more than 1800 years, spanning the Middle Preclassic (900-300 BC) through to the Late-to-Terminal Classic (AD 550-900). The research presented in this volume reveals a summary of this critical data on Pacbitun's humble beginning as a small farming community around 900 BC to its rise as one of the preeminent regional civic-ceremonial centres dating to 400/300 BC. We have also tracked extensively the ebb and flow of the site's prowess as the people of Pacbitun navigated the murky political waters of the Classic period (AD 250-900). As a result, we have been able to piece together many of their daily and ritual activities over the course of nearly two millennia.

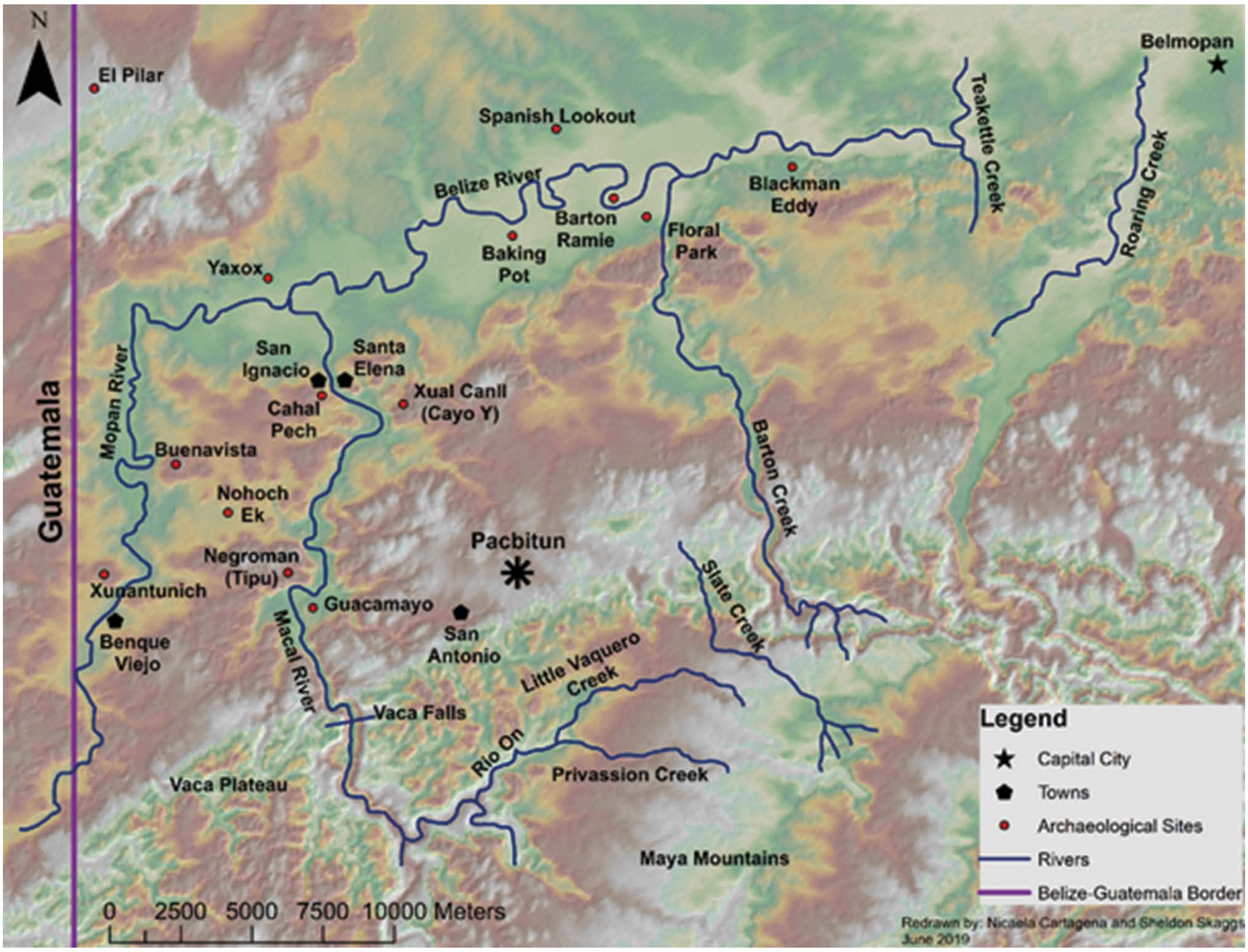


Figure 1.1. Map of Belize Valley showing location of Pacbitun. Map courtesy of Nicaela Cartagena.

The chapters in this volume are the culmination of a symposium entitled 'Researching the Ancient Maya of Pacbitun, Belize: A Decade of Archaeological Discovery' that was presented at the 2018 Society for American Archaeology meetings in Washington, DC. The primary goal of this symposium was to provide a current cross-section of archaeological research on the nature and significance of Pacbitun within the broader context of the Belize Valley and beyond. It was hoped that the symposium would help define and refine the cultural history of the site, by clarifying the cultural trajectory from its beginnings in the Middle Preclassic through to its denouement in the Terminal Classic period. In this volume, those presentations have been revised and updated to include recent findings, as well as provide new theories and methodologies regarding the social, political, and economic relationships between Pacbitun and other sites in the region. This volume also includes specialised analyses of ceramics, lithics, and organic remains that address questions of social and ritual life, and also the production, trade, and exchange of various material culture items.

The volume is divided into two themes: chapters dealing with the epicentre or core zone, and those dealing with the peripheral zone. Within each theme there are chapters dealing with research questions touching on all levels of society and spanning the 1800-year history. Before discussing the chapters in detail, it is important to briefly outline/summarise the previous archaeological projects at Pacbitun and the research focus by each project in their attempt to reconstruct the lifeways at the site. This historical summary combines less detailed descriptions of early research project achievements, presented in full in chapter two, with those from the last decade of archaeological activities at Pacbitun.

Project History of Pacbitun

Trent University-Pacbitun Archaeological Project (1984-1987)

Pacbitun, which means 'stone set on earth' in Yucatec Maya, was first investigated in the 1980s by Paul Healy of Trent University (Healy 1990a). Healy was drawn to Pacbitun because of the extensive hilltop terracing encircling the site. In order to better understand the terraced periphery, Healy began a limited testing programme in the central precinct in 1984. This fieldwork revealed a lengthy history of occupation for Pacbitun, spanning the Late Preclassic through Late Classic periods. Based on these initial results, he formed the Trent University-Pacbitun Archaeological Project and returned in 1986 and 1987 for more intensive study. Healy's project focused on two programmes of investigation: the core zone and the peripheral zone. His main goal was outlining the 'development and evolution of this Classic Maya centre and determining the role of intensive terrace agriculture' (see chapter two, this volume; Healy 1990a:249).

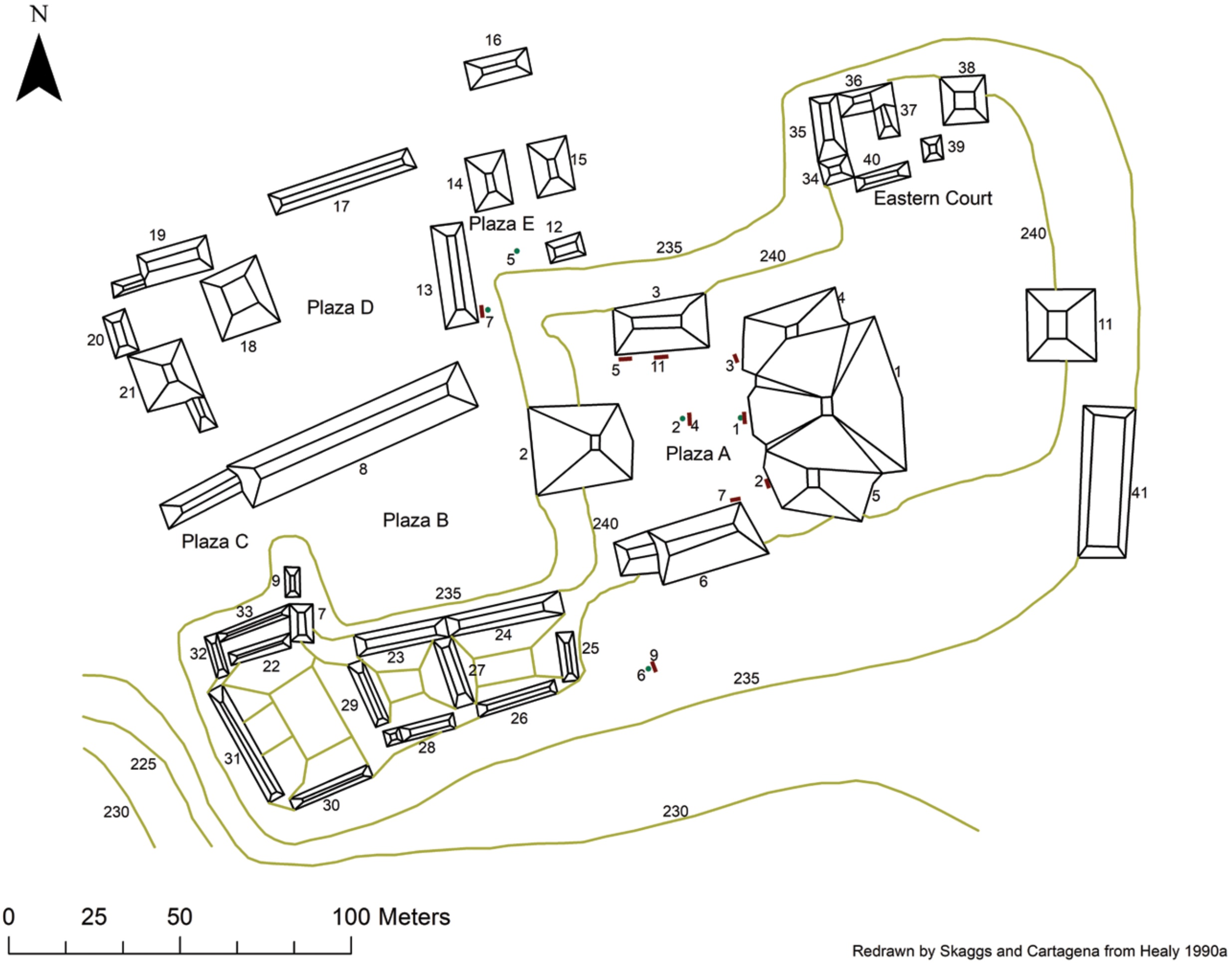
In the epicentre, Healy mapped 41 buildings that were arranged around five plazas (A-E) (Figure 1.2). In addition, he recorded two causeways, one reservoir, and 19 stone monuments. He investigated eight structures (Structures 1, 2, 4, 5, 14, 15, 23, and 38) in different plazas, with the majority of this work conducted in Plazas A and E. These plazas contain the site's E Group and ballcourt, respectively. Plaza A contained the greatest concentration of Classic period burials (n=20) and caches (n=19), many associated with the E Group structures (see chapter five, this volume). The majority of the 19 stone monuments found by Healy were also located in Plaza A. Many of the monuments were placed in front of structures associated with the E Group and, of these, three are carved (Altars 3 and 4, and Stela 6).

In the core and peripheral zones, Healy conducted extensive survey within a one square km area around the epicentre. A total of 330 mounds were mapped. Fifty of these mounds were tested (Campbell-Trithart 1990; Richie 1990; Sunahara 1995), with all of them producing Late Classic pottery. Based on his excavations, he was able to estimate a population size of about 6,000 inhabitants during Late Classic times (Healy *et al*. 2007).

These excavations into the monumental architecture and housemounds also allowed Healy to establish a ceramic sequence for Pacbitun (see chapter two, this volume). His five ceramic complexes were cross-dated with a number of other Belize Valley sites, including Barton Ramie (Gifford 1976).

Trent University-Preclassic Maya Project (1995-1997)

In the mid-1990s, Healy and Jaime Awe secured multi-year funding from the Social Sciences and Humanities Research Council (SSHRC) of Canada to pursue investigations of the earliest occupation of the site. Specifically, the main goal of the Trent University-Preclassic Maya Project was committed to a resolution of some key archaeological problems associated with the Preclassic Maya (Healy and Awe 1995), and to improve the understanding of an important lowland region (Upper Belize River Valley) which was under-represented for the temporal horizon (Healy and Awe 1995:3). At Pacbitun, research was targeted in Plaza B. In previous years, Plaza B had yielded the earliest architectural remains dating back to ca. 900 BC. With excavations located at the base of Structure 8 on the plaza side, Healy and colleagues identified the remains of four platforms (Sub-Structures B1-B4) that were buried beneath a late Middle Preclassic (ca. 600-300 BC) midden. These four platforms, two belonging to the early Middle Preclassic (900-600 BC) (Sub-Structures B1 and B4), and the other two dating to the late Middle Preclassic (600-300 BC) (Sub-Structures B2 and B3), were partially unearthed. Evidence for shell working was found in and around all four platforms. Thousands of shell beads, both finished and unfinished, along with production debris and chert micro-drills used to perforate the beads were found. The majority of the material was identified as conch shell



Redrawn by Skaggs and Cartagena from Healy 1990a

Figure 1.2. Map of Pacbitun site core. Map courtesy of Sheldon Skaggs and Nicaela Cartagena.

(specifically Florida Fighting Conch), a marine gastropod found in the Caribbean Sea some 100 km (60 miles) from the site. These workshops were used for nearly 600 years, indicating the economic importance of marine shells during the Middle Preclassic (see chapters three and four, this volume).

Pacbitun Preclassic Project (2008-2010)

Powis resumed excavations at Pacbitun after a decade-long hiatus, and assumed the role of PI, beginning in the summer of 2008. The first three years of this small project were focused exclusively on further defining the Middle Preclassic period in Plaza B (see chapter three, this volume). The investigations in the mid-1990s had revealed substantial Middle Preclassic domestic architecture, but none of the platforms had been fully unearthed. Powis' main goal was to horizontally expose Sub-Structure B2, which was accomplished in 2010. This rectangular platform measured 9 m east-west by 6 m north-south. Similar to the investigations in the mid-1990s, thousands of shell beads and shell detritus were recovered as well as several hundred chert drills. The beads and drills were found not only embedded in the floor of Sub-Structure B2 but also along the perimeter of the platform.

Pacbitun Regional Archaeological Project (2011-present)

In 2011, investigations modelled after the approach taken by Healy in the mid-1980s shifted to include research in the periphery. Healy had already mapped and sampled numerous housemounds and minor centres within a 2 km radius of the site, so emphasis of the new research involved other features such as production sites, causeways, and caves, (see chapters ten-fifteen, this volume). The Mai Causeway and Tzul Causeway, which extend from the site core out into the periphery, were surveyed but never excavated by Healy. One of the main goals of our causeway research was to determine when each was constructed. While it was clear that the Mai Causeway terminated at a large temple-pyramid complex (Structure 10), finding the termination of the Tzul Causeway was one of the primary goals of this research. It was important to determine whether the Tzul Causeway terminated at a minor centre in the periphery or at one of the dozens of caves that are located to the south of the site core. Research into the caves as well as other karst features (e.g., rockshelters, sinkholes) focused on asking questions concerning when, how, and why the Maya utilised these features throughout the Classic period.

Additional work in the periphery involved the investigation of another large-scale production locale.

Like the Pacbitun Maya of the Middle Preclassic, those in the Classic period were also producing goods needed at the site and perhaps traded to a wider region. In 2011, through the process of resurveying some housemounds along the edge of Healy's northwest transect, Drew Ward discovered an area where granite was crafted into manos and metates. Further excavations of this area suggest this was a large-scale groundstone production area—the first to be discovered in Belize (see chapter fourteen, this volume; Ward 2013).

In the site epicentre, the Middle Preclassic research focus shifted from the domestic architecture located in Plaza B to a search for ceremonial architecture in Plaza A (see chapter three, this volume). Because all research conducted in Plaza B to this point appeared to suggest that this area served a residential function from the Middle Preclassic onwards, it was reasonable to assume that Plaza A could have also had a continuous ceremonial function and would be the location of the first ceremonial constructions, buried beneath the plaza like the architecture in Plaza B. To aid in our sub-plaza search, we began a programme of geophysical survey in 2012, which included both magnetometry and ground penetrating radar. By sending microwave radiation into the ground and receiving the reflections of the waves off changes in soil, Skaggs was able to identify numerous anomalies in Plaza A. The most interesting anomaly, located at the north end of the plaza, revealed a large, nearly intact Middle Preclassic ceremonial platform designated by the excavators as 'El Quemado' (henceforth referred to as Q). Located about 50 cm below the present-day ground surface, Q measures 32 m (east-west) by 20 m (north-south) and stands approximately 2 m tall. The massive size of Q, and the need to backfill excavations at the end of each summer, meant that the entirety of the structure would never be completely exposed all at once. We therefore had employed both terrestrial laser scanning and photogrammetry each season, and then stitched the models together to visualize the structure as a whole (see chapter seven, this volume). Despite its accuracy, the time and expense required for laser scanning made it impractical to implement each season. High quality, overlapping photographs taken by Jeff Powis, supplemented with overhead drone photographs, were taken at the end of each excavation season. The images produced proved more than adequate for capturing all of Q's intricate details once processed using multiple 3D modelling software programs.

Given the size, scale, and time period of Q, we were forced to re-evaluate our understanding of the evolution of ritual practice in Plaza A. In 2015, investigations focused on the E Group and the development of this architectural complex. It was determined that the E Group was first constructed after the abandonment of Q around 400/300 BC (see chapter five, this volume).

As we came to learn more about the earliest history of Pacbitun's epicentre, we also wanted to expand our knowledge of the Classic period residential developments of the nobility. We began an in-depth study of the courtyards in the site core, the presumed residences of the royal families during the Classic period. To date, we had no knowledge of those ruling the site other than elite burials recovered from the four structures of the E Group. This changed when a centre unit in Court 3, placed to capture the chronology of the courtyard's establishment and construction history, found multiple caches and seven individuals buried within four cist graves (see chapter six, this volume). Among the elaborate artefacts associated with these burials was an Ulúa Valley marble vase and marine shell finger-loops of an atlatl. Evidence of ritual practices in caching deposits included the discovery of obsidian and chert eccentrics. Other excavations in the centre of each courtyard and into structures revealed the rapid construction of this area and the growing restriction of access during the Late Classic period.

On the eastern side of Court 1 in Structure 25, the recovery of a carved altar fragment in 2017 led us to question our knowledge of the political history of the site during the Late and Terminal Classic periods. Found cached within a passage between rooms belonging to a previous late Late Classic construction phase, the carved altar fragment was identified as a piece of the Early Classic period Altar 3—a carved monument discovered within the largest building on site, Structure 1. Finding broken pieces of the same monument in different areas of the site core raised a number of questions regarding Pacbitun's role in the politics of the Belize Valley beyond the 8th century (see chapter nine, this volume). At this same time, we were recovering numerous Terminal Classic sherds from structures in the site core. In previous research efforts, Terminal Classic sherds were only found in the periphery. With a more robust assemblage of artefacts from this time period, we are beginning to understand the events that took place during the collapse and abandonment periods shortly after the 9th century (see chapter sixteen, this volume). The addition of this new evidence from the last 100 years of site occupation allowed the authors to make a revision of the chronology for the site. We modified the timing of Healy's Late Classic period to Terminal Classic period division, and also added an Early Postclassic period of AD 900-1000 (see Table 1.1), an addition that appears to correlate well with other Belize Valley sites.

As mentioned above, each chapter of this volume is divided between two organising themes based on research conducted in either the epicentre or the peripheral zone. The remainder of this introduction is an overview of each chapter. For the epicentre research, chapters are organised chronologically starting at the Middle Preclassic through to the Late-to-Terminal Classic. For the peripheral zone research, chapters will focus almost exclusively on the Classic period, as there is little to no evidence yet that Preclassic occupation occurs in the hinterland area of Pacbitun.

Table 1.1. Refined Pacbitun chronology and ceramic sequence of Pacbitun (adapted from Healy *et al.* 2004:208).

Time Period	Cal. Years	Pacbitun		Belize Valley			Pasion	Peten	
		TU-PAP*	PRAP**	Barton Ramie	Cahal Pech	Xunantunich	Ceibal	Uaxactun	Tikal
Postclassic	---1200----	▨	▨	late New Town	▨	▨	▨	▨	▨
							Samat		Caban
	---1100----			early New Town					
	---1000----								
			Canto				▨		
	----900----						Bayal	Tepeu 3	Eznab
Terminal Classic		Tzib	Tzib	Spanish Lookout	late Spanish Lookout	Tsak'		Tepeu 2	Imix
	----800----								
Late Classic			late Coc		early Spanish Lookout	Hats' Chaak	Tepejilote 3		
	----700----						Tepejilote 2		
		Coc	early Coc	Tiger Run	Tiger Run		Tepejilote 1	Tepeu 1	Ik
	----600----					Samal			
Early Classic				Hermitage		Ak'ab	Junco 4		
	----500----	Tzul	Tzul		Hermitage			Tzakol 3	Manik 3
							Junco 3	Tzakol 2	
	----400----								
							Junco 2		Manik 2
	-----300----				late Xakal				
Terminal Preclassic		Ku	Ku			Pek'kat	Junco 1	Tzakol 1	Manik 1
	----200----			Floral Park				Chicanel	Cimi
							Xate 3		
	----100----						Xate 2		Cauac
					early Xakal				
	- BC/AD -						Xate 1		
				Mount Hope					Chuen
	----100----						Cantutse 3		
Late Preclassic		Puc	Puc	Barton Creek		Ok'inal			
	----200----						Cantutse 2		
	----300----								
Middle Preclassic		late Mai	late Mai	Jenny Creek		Nohol	Cantutse 1		
	----400----				late Kanluk		Escoba 3	Mamon	Tzec
	----500----						Escoba 2		
	----600----								
		early Mai	early Mai				Escoba 1	Eb	late Eb
	----700----								
					early Kanluk		Real 3		early Eb
	----800----								
				▨		Muyal	Real 2		
	----900----						Real 1		
Early Preclassic		▨	▨		Cunil			▨	
	---1000----								
							▨		▨
	---1100----								
						▨			
	---1200----								
					▨				

* TU-PAP = Trent University-Pacbitun Archaeological Project (Healy 1990a).

** PRAP = Pacbtiun Regional Archaeological Project (Powis *et al.* 2017).

Investigations in the Site Epicentre

In chapter two, Healy introduces the early history of archaeological research at Pacbitun, including the site discovery, initial project objectives, and chronology. He reviews the environmental setting of Pacbitun and the wide range of resources that the ancient inhabitants were able to exploit from both the tropical rain forest and the Mountain Pine Ridge. Specifically, Healy details the rich flora, fauna, and geological resources offered by the diverse environs. The most significant architectural features of the site within this natural setting are characterised. An outline of the major excavations of 1984-1987 and 1995-1997 follows, with highlights about the investigations of key structures and associated burials, caches, and monuments. Results of a multi-year settlement pattern survey of Pacbitun and its periphery, with demographic estimates, are noted. Evidence for early artefact production and inter-regional trade are also reported.

In chapter three, Powis focuses on gaining a more comprehensive understanding of the Middle Preclassic

(900-300 BC) community at Pacbitun. Multi-year excavations of sub-plaza deposits in the plazas and courtyards of the central precinct have revealed considerable architectural and artefactual remains dating to this early time period. This chapter elaborates on and synthesises the new information gathered from these more recent investigations across the site core and then explains how this data has contributed to our knowledge of the Middle Preclassic occupation. Powis ends this chapter by comparing Pacbitun to other early Maya sites located in the Belize Valley and across the lowlands.

In chapter four, Boileau and Stanchly examine Pacbitun's Middle Preclassic community through the lens of faunal use. The assemblage is composed of faunal material gathered from excavations in Plaza A and B over the past two decades. The primary function of these areas, enduring as ritual and residential locales respectively throughout the site's occupation, resulted in two diverse assemblages that provided information concerning acquisition, consumption, and deposition of a broad range of vertebrate and invertebrate specimens. This examination was also able to detail craft production, economic exchange, and social differentiation as well as ritual/domestic function, each helping to reveal diverging groups and communal activities during the Middle Preclassic leading to potential access restrictions for animal resources. Ultimately, the comparison of faunal patterns would illuminate the evolving social class dynamics emerging early at the site.

In chapter five, Micheletti discusses the changing role of the E Group architectural complex. A recent re-examination of E Group complexes in the Belize Valley has determined that these assemblages share a unique set of attributes atypical of the E Group that would ultimately designate these assemblages as a variant form of this archetype (Awe *et al*. 2017). Also exhibiting the unique attributes of the Belize Valley regional variant, now referred to as an Eastern Triadic Assemblage, Pacbitun's complex was used as a primary example of the regional study. In this chapter, Micheletti provides an in-depth assessment of Pacbitun's E Group assemblage through a temporal examination of its construction history to identify the installation and development of the attributes that now label this assemblage an E Group variant. Each construction episode clearly demonstrates Pacbitun's early connection to the Belize Valley, the assemblage sharing most of the physical characteristics that differentiate this region's architecture from the quintessential E Group complex. Yet, certain attributes exhibited after the initial construction phases are not as distinct and actually conflict with the regional designation. The study in this chapter finds that the attributes that connect Pacbitun's assemblage to the Belize Valley regional variant are not wholly expressed until a Late Classic construction event.

In chapter six, Skaggs and his colleagues examine the structures that compose Pacbitun's palace courts bounding the southern edge of the site core. These excavations would build on the investigations of Structure 23 starting in 1987 to enhance our understanding of what was believed to be Pacbitun's royal residency. From 2016-2019, excavations have focused on the centre of each courtyard, set to determine the chronological sequence of construction, as well as several of the range structures that surround the courtyards. Discoveries beneath the central courtyard (Court 2), similar to those in Plaza A and B, continue to increase our understanding of the Middle Preclassic community. The structures and courtyards of the adjacent courts (Courts 1 and 3), on the other hand, appear to have all had a much later origin, the majority dating to the onset of the Late Classic period (AD 550). Interestingly, the construction of Courts 1 and 3 appear to be associated with a site-wide Late Classic construction event brought about by a sudden florescence at Pacbitun. Through an examination of the architecture, access, caches, and burials of these palace courtyard groups, we consider the likelihood that the courts served as a royal residence of the site.

In chapter seven, Vaughan and his colleagues synthesise the current research practices of using mapping-grade photogrammetry at the site of Pacbitun. Advanced geospatial recordation and survey methods have always been a part of research at Pacbitun. Since 2015, a programme of photogrammetric modelling of excavation operations has taken place, to capture images used to then create 3D models. This chapter addresses the challenges and successes in creating mapping-grade 3D models derived solely from digital photographs. By taking a flexible, iterative approach, the authors have overcome the challenges in deploying and organising photogrammetry in settings hostile to both accurate GPS data collection and photography.

In chapter eight, Cheong discusses wind instrument production at the site. The ancient Maya were known for their rich ceremonial lifestyle in which music produced by instruments played an important role as shown on the murals of Bonampak. While other sites have produced more instruments than Pacbitun, our excavations have revealed a wider range of types, forms, and sound variety than any other Classic period site. The context of the instruments were examined using macro- and micro-analysis and petrographic analysis finding that some had been produced locally. A full listing and description of the assemblage is provided for comparison at other Maya sites.

In chapter nine, Micheletti and colleagues examine Classic period political affairs of Pacbitun through an extensive examination of two carved monuments at the site. Stela 6 and Altar 3 are thought to date to the Early Classic period, determined stylistically through epigraphic and iconographic analysis, and archaeologically through contextual analysis. As this chapter will demonstrate, the modes of analysis used to date these monuments also provide clues to the political status of Pacbitun before and after the Early-to-Late Classic transition. Text and imagery of Stela 6 and Altar 3 contain toponyms that not only reference the realm(s) of Pacbitun but may also name other locales associated with potential affiliates. More importantly, Stela 6 appears to include a statement that would confirm the site's subordinate status in the latter half of the Early Classic. The context and condition of these monuments are also discussed in depth and appear to be congruent with archaeological evidence that may suggest conflict and subsequent socio-political change.

Investigations in the Site Periphery

In chapter ten, Spenard and his colleagues provide a summary of the ceremonial use of Pacbitun's karstscape, including caves and rockshelters. The discussion details the many types of karstic landmark features that fall within the category of *ch'een*, an area considered by the ancient Maya to be portals to powerful deities and other non-human agents. The chapter includes a description of several of these landmarks and associated modifications for rituals, most of which are thought to be associated with water. The authors' investigations find that the use of ritual landmarks, starting as early as the Late and Terminal Preclassic periods, had intensified by the Late and Terminal Classic periods and may have been controlled by Pacbitun elite. Their study also illuminates cultural ties with Xunantunich evinced in the abundance of Late Classic pottery types associated with this Belize Valley centre found within karst deposits at Pacbitun.

In chapter eleven, Parker and Spenard outline the paleoethnobotanical work conducted in the karstscape at Pacbitun demonstrating the vast history of plant use in such spaces. In particular, the burning of wood from spiritually significant trees was a critical component of Late Classic Maya cave rituals. Through examination of the control of specific resources, it is possible to evaluate the role these ritual spaces played in the lives of regular people and the presence of a centralised religious authority. Details of all identified species offer more nuanced pictures of the diverse spiritual needs of the Maya throughout the Pacbitun community.

In chapter twelve, King and his colleagues explore absorbed residues found in ceramic containers and bone tubes recovered from caves, mortuary contexts, and ritual caches in the Pacbitun region. The ceramic vessels presumably held liquids consumed or otherwise used in rituals in these settings, while the bone tubes may have delivered substances to participants in those rituals. Results of their analyses shed light on the kinds of substances used in rituals associated with caves, enemas, and caching.

In chapter thirteen, Weber and Spenard investigate the complex causeway systems connecting non-settlement cultural constructions and features such as caves and springs in the periphery of Pacbitun. Causeways are ever-changing assemblages associated with socio-economic and ideological developments in the periphery of the site. Using traditional and geospatial investigation methods, the authors determine to what extent traces of these influences are observable in the archaeological record. This chapter seeks to identify whether the causeway systems allow for interpretation of changing ideological motivations during the Late-to-Terminal Classic period? Understanding the Pacbitun causeway system within the centre and its connections in-between structures and caves in the periphery will hopefully aid in our understanding of the ancient Maya people who once lived in and around Pacbitun.

In chapter fourteen, Skaggs and colleagues investigate granite groundstone artefacts from the Tzib Group, a small group of mounds located in the periphery of Pacbitun. Numerous manos and metates, in various stages of production, along with production debris and the stone tools used to manufacture these implements were found at the Tzib Group. Using the pXRF method discussed by Tibbits in chapter fifteen of this volume, it was determined that the Maya of Pacbitun were obtaining the raw materials for production from the Mountain Pine Ridge, located just a few kms south of the site. The layout of the Tzib Group, the tools used by their makers, and the debris left behind aids in the interpretation of groundstone production, use, and distribution.

In chapter fifteen, Tibbits examines the ability of portable X-ray fluorescence (pXRF) to generate accurate geochemical signatures on coarse-grained granite. The accuracy of this new use of pXRF was tested by comparison between thin section petrography and lab-based XRF to the pXRF results. The results indicate that when using the average geochemical signature of a minimum of five data points per sample, pXRF produces results that are statistically indistinguishable from lab-based XRF. With this accurate geochemical signature obtained with pXRF for the three granitic plutons within the Maya Mountains, the author was able to match groundstone tools produced at Pacbitun to the correct granite source material.

In chapter sixteen, Helmke and Ting analyse mould-made Terminal Classic pottery from the periphery of Pacbitun. The Terminal Classic witnesses the disappearance of polychromatic decorations and the appearance of highly decorated and near-identical, mould-made ceramics. The emergence of the molded-carved tradition is intimately correlated to increasing decentralisation of power and the fall of the institution of kingship. The vast majority of these moulded-carved ceramics were consumed and utilised by non-royal social segments that rose to power in the vacuum left in the collapse of the system of divine rulership. These moulded-carved ceramics are so distinctive that they serve as horizon markers for the whole period. Based on the evidence from various sites in the eastern lowlands, the production of these vessels is characterised by the co-existence of multiple traditions, including those based on volcanic ash and calcite pastes. Through an analysis of the imagery and associated texts, along with the physical properties of these vases, these traditions serve as a framework for revealing the production features, subsuming the selection of raw materials, paste preparation, forming, surface finish and firing methods, as well as determining the spheres in which the vases were circulated and how Pacbitun prospered in these spheres.

In sum, this volume presents the fruits of a decade of continued research at the ancient Maya site of Pacbitun, Belize. Continuing the research goals of Paul Healy, the authors have used innovation along with novel methods and data to investigate both the epicentre and peripheral zones of the site. Traditional excavations in the site core have revealed expanded ceremonial and domestic areas and activities, and defined new aspects of the cultural history of the site. The investigation of the karstscape, causeways, along with specialised analyses of ceramics, lithics, and organic remains help to answer questions about the social and ritual life, and also the production, trade, and exchange of various material culture items. Throughout all the years of work, the researchers at Pacbitun have strived to adopt innovative methodologies and technologies in order to gather new and accurate archaeological data for the benefit of future research.

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2

Ancient Pacbitun: An Introduction to the Archaeological Site and Early Research

Paul F. Healy

The ancient Maya site of Pacbitun, located in the Cayo District of west central Belize, is a medium-sized regional centre. It is situated on the southern edge of the Upper Belize River Valley (see Figure 1.1), and is one of a number of lowland Maya centres of similar size (e.g., Baking Pot, Blackman Eddy, Buenavista, Cahal Pech) which flourished in this region of the eastern Maya Lowlands during the Classic period (AD 250-900) (Garber 2004; Healy, ed., 1999; Willey *et al*. 1965). In the late 1970s, the author was in Belize (then British Honduras) searching for archaeological evidence of ancient Maya intensive agriculture, most notably in the form of relic hillslope terracing. There was considerable debate at this time regarding the subsistence base of the ancient Maya, and significant new evidence was emerging for advanced, complex, systems of agrotechnology (Harrison and Turner 1978; Sanders 1972, 1979; Siemens and Puleston 1972; Turner 1974; Wilken 1971).

In 1980, following two years of terrace investigations at the Chiquibul Forest sites of Blue Hole Camp, Caledonia, Caracol, and Mountain Cow, further to the south, we noted remnants of early, boulder-edged terrace walls on hillsides in the vicinity of Pacbitun, a site first recorded by officials from the Belize Institute of Archaeology only a few years earlier (Healy 1983, 1990a:248-249; Healy *et al*. 1980; Healy *et al*. 1983; Healy *et al*. 1998)[1]. As part of a major Trent University project, we conducted a preliminary surface survey that season at Pacbitun. This revealed very good preservation of monumental architecture in the heart of the site, and indications that Pacbitun was the ancient Maya community most closely associated with the visible, nearby terraced fields.

In 1984, a short field season was conducted at Pacbitun, with initial site mapping and test excavations in Plaza A, the main ceremonial plaza of the site. From this research, we were able to determine that the site covered several square kms, and likely had a lengthy prehistory, beginning sometime during the Preclassic period. With support from Trent University and the Social Sciences and Humanities Research Council (SSHRC) of Canada, we returned to investigate Pacbitun for prolonged field seasons in 1986 and 1987 and, again, between 1995 and 1997. Based on this research, and a battery of radiocarbon dates, it became clear that the site history spanned at least 1800 years, from about 900 BC to AD 900 (Healy 1990a: Table 1, 1999: Table 2; Healy *et al*. 2004c:208). During this period of nearly two millennia, Pacbitun grew to at least 9 kms^2 in size, while the site population in the Late Classic period (AD 550-800) had risen, minimally, to between 5,000-6,000 persons (Healy *et al*. 2007). There was little to no evidence unearthed, at this time, for Maya habitation beyond AD 900, in the Postclassic period.

Environmental Setting

Pacbitun is situated at the juncture of two sharply contrasting micro-environments: tropical rainforest and mountain pine ridge. The area immediately around the site, and to the north, is marked by remnants of what was once an extensive lowland broadleaf forest, with rolling hills and rich agricultural soils stretching all the way to the valley floor of the Belize River, about 13 km to the north, and its tributary, the Macal River, about 8 km to the west. In contrast, to the south of Pacbitun, at about 3-4 kms, are pine-covered uplands, part of the foothills of the Mountain Pine Ridge, covered mostly by poor, sandy soils. The region immediately surrounding the site centre is dotted with multiple, reliable springs, and is interspersed with a number of freshwater creeks and streams.[2] It seems likely that the ecological diversity of this region, with a wide range of different natural resources (e.g., flora, soils, minerals, freshwater, and fauna), and its elevated location, is what first attracted settlement at Pacbitun by the Preclassic Maya (Graham 1987b; Healy 1990a; Healy and Emery, eds., 2014). As best we can determine this initial habitation, in the form of a small farming village, was established about 900 BC, and is the focus of some of the research discussed in this volume (Healy 2006; Healy *et al*. 2007; Healy *et al*. 2004c, 2008a).

Like much of the Central Maya Lowlands, the vegetation of the Belize Valley (including the region around Pacbitun) is classified as a tropical rainforest (McKillop 2004:35-

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[1] Dr. Peter Schmidt, then Archaeological Commissioner of British Honduras (Belize), was called to investigate the site in 1971, when Public Works crews damaged an archaeological mound (perhaps Pacbitun Structure 41) while extracting limestone ballast to construct the San Antonio road adjacent to the site. The name Pacbitun is attributed to Schmidt, who translated the local site name (*piedras sembrada* or 'stones set in earth') into Maya, likely in reference to several partial stelae (standing and fallen) found at the site. No excavations were conducted at the time, and the original Maya site name is presently unknown.

[2] It is interesting to note that the modern Maya community of San Antonio (Cayo), located only about 3.5 kms to the west of Pacbitun, often faces serious water shortages during the annual dry season, while the main waterhole in the Core Zone of Pacbitun, and several nearby springs, do not seem to dry up. The very reliable freshwater sources here may have been a key factor in the original (Middle Preclassic) settlement of this particular locale.

36). Due to the substantial rainfall, averaging about 1500-2000 mm per year (Hartshorn *et al*. 1984: Fig. II-3), the vegetation in antiquity likely consisted of a dense, evergreen, broadleaf forest, with trees such as mahogany (*Swietenia macrophylla*), ceiba or cottontree (*Ceiba pentandra*), nargusta or guayabo (*Terminalia obovata*), Santa Maria (*Calophyllum brasiliense*), ironwood (*Dalium guianens*), rosewood (*Dalbergia stevensonii*), chicle or chiquibul (*Manilkara zapota*), allspice (*Pimenta sp.*), bullet-tree (*Bucida buceras*), logwood (*Haematoxylum campechianum*), and various native plants, such as the cohune (*Orbignya cohune*) and botán (*Sabal morrisiana*) (Sharer with Traxler 2006: Figure 1.6; Wright *et al*. 1959:28-33, Appendix III). Many of these species would have been of obvious use, and economic importance, to the ancient Maya (Lentz 1999; Lentz *et al*. 2005; McKillop 1994, 1996; Turner and Miksicek 1984).

Macrofloral analysis of botanical samples (especially charcoal and seeds) excavated from Preclassic period contexts at Pacbitun have been specifically identified: pine (*Pinus sp.*), surely derived from the nearby Mountain Pine Ridge, turtlebone (*Pithecellobium sp.*), and ramon or breadnut (*Brosimum alicastrum*), while wild fig or amate (*Ficus sp.*), malady or my lady (*Aspidosperma sp.*), coyol palm (*Acrocomia aculeate*) and glassy wood or palo mulato (*Astronium sp.*) have been identified from similar, early deposits at neighbouring Cahal Pech (Wiesen and Lentz 1999: Table 1). Also, from the latter are the remains of domesticates such as maize (*Zea mays*), beans (*Phaseolus sp.*), squash (*Cucurbita sp.*), and cotton (*Gossypium sp.*). The fact that many of the tree specimens identified from charcoal remains at Pacbitun (and nearby Cahal Pech) are from large hardwoods, typical of a primary forest setting (or Mountain Pine Ridge in the case of pine) suggests that the early Maya were harvesting from mature forests, most particularly from a neotropical deciduous forest dominated by broadleaf species, as well as from the nearby pine ridge (Lentz *et al*. 2005; Wiesen and Lentz 1999:65). This provides insights to the type of animal habitats that would have been available in antiquity near Pacbitun, and has implications for the kind of faunal exploitation that was possible by the early Maya.

Today, botanists classify the region near Pacbitun as a ‘Subtropical Mist Forest’ ecological zone, marked by a *tierra caliente* climate (Hartshorn *et al*. 1984: Figure IV-16; Sharer and Traxler 2006: Figure 1.6). Much of the original forest cover of Pacbitun has been cleared primarily by the Maya population of the nearby community of San Antonio (Cayo) for modern agricultural and ranching activity. Local crops today include corn, beans, squash, peanuts, pineapple, and plantain (Terry G. Powis, personal communication, 2009). Soils are generally deep, a bit stony in places, and fertile, especially in low-lying zones between the hills around Pacbitun. Scattered about the region today are patches of remnant, ancient rainforest. In most cases, this is presumed to be a secondary rainforest, with most of the original flora almost certainly cleared in antiquity by the Classic Maya. In places, dense *huaymil*, composed of low scrub and thorn growth, such as acacia, or cockspur (*Acacia sp.*) covers the terrain today.

The residents of early Pacbitun used animals for both subsistence and ceremonial purposes (see chapter four, this volume; Boileau 2014; Emery and Baker 2014; Emery and Healy 2014; Healy *et al*. 2014; Stanchly 1999, 2014). The range and variety of fauna at Pacbitun are similar to those identified at other lowland Maya sites (Pohl 1976; Powis *et al*. 1999; Wing and Steadman 1980). The majority of vertebrate species identified in the assemblage were likely hunted in an opportunistic manner (Table 2.1).

Table 2.1. List of identified taxa from Pacbitun (after Healy and Emery 2014: 213-218, Appendix 1).

Order/Class/Family	Genus/Species	Common Name
Mammals (Mammalia)		
Artiodactyla		
Cervidae	*Odocoileus virginianus*	White-tailed deer
	Mazama sp.	Brocket deer
Tayassuidae	*Tayassu pecari*	White-lipped peccary
	Tayassu tajacu	Collared peccary
	Tayassu sp.	Peccary
Perissodactyla		
Tapiridae	*Tapirus bairdii*	Baird’s tapir
Sirenia		
Trichechidae	*Trichechus manatus*	Manatee
Primata		
Cebidae	*Alouatta villosa*	Black howler monkey
Carnivora		
Candidae	*Canis lupus familiaris*	Domestic dog
Felidae		Cats

Lagomorpha		
Leporidae	*Sylvilagus* sp.	Cottontail rabbit
Rodentia		
Cuniculidae	*Cuniculus paca*	Lowland paca
Dasyproctidae	*Dasyprocta punctata*	Central Am. agouti
Erethizontidae	*Coendu mexicana*	New World porcupine
Muridae	*Ototylomis phyllotis*	Big-eared climbing rat
	Oryzomys sp.	Rice rat
Heteromyidae	*Liomys salvini*	Salvin's pocket mouse
Geomyidae	*Heterogeomys hispidus*	Hispid pocket gopher
Dasypodidae	*Dasypus novemcinctus*	Nine-banded armadillo
Marsupialia		
Didelphidae	*Didelphis marsupialis*	Common opossum
	Marmosa sp.	Mouse opposum
Birds (Aves)		
Galliformes		
Phasiandidae	*Meleagris* sp.	Turkey
Cracidae	*Crax rubra*	Great curassow
Passeriformes		Perching birds
Reptiles (Reptilia)		
Testudines		
Dermatemydidae	*Dermatemys mawi*	Cent. Am. river turtle
Kinosternidae	*Kinosternon* sp.	Mud and musk turtle
	Staurotypus triporcatus	Giant musk turtle
Cheloniidae	*Chelonia* sp.	Green turtle
Crocodylia		
Crocodylidae	*Crocodylus acutus*	American crocodile
	Crocodylus moreleti	Morlet's crocodile
Serpentes		Snakes
Amphibians (Amphibia)		
Anura		Frogs and toads
Fish (Osteichthyes)		
Ictaluridae	*Ictalurus* sp.	Freshwater catfish
Rays (Chondrichthyes)		
Rajiformes		
Dasyatidae		Stingray
Myliobatidae		Eagleray
Crustaceans (Crustacea)		
Brachyura		
Gecarcinidae	Cardisoma guanhumi	Blue land crab
	Menippe mercenaria	Stone crab

Analysis of ecozone utilisation suggests that most hunting was done primarily in uncut forests (Emery and Healy 2014). Animals like the great curassow, monkeys, and the white-lipped peccary, prefer virgin forest as do most of the large felines. Hunting by Maya farmers in their corn fields (milpas) was also very likely (Pohl 1976, 1983). Many species identified from Pacbitun were most likely hunted in regrowth forests (*huaymil*). Collared peccary, agouti, and armadillo are occasionally found here. Another ecozone of importance was the cut forest (including residential areas and newly cleared agricultural lands). These forests would have attracted brocket and white-tail deer, as well as collared peccary, turkeys, snakes and various rodents. Pacbitun is farther from a riverine ecozone, but some elements of the assemblage, like river turtles, and freshwater gastropods, suggest that the Pacbitun Maya made frequent trips to smaller, nearby creeks and streams, and occasionally to the Macal River for both potable water and edible species. Immense numbers of freshwater snails (*jute*; *Pachychilus sp.*) have been reported from Pacbitun, and these gastropods surely served as a food supplement and continue as such among the local, modern Maya (Healy *et al*. 1990). The occasional remains of freshwater clams, iguanas, and crocodiles are additional evidence for the exploitation of nearby riverine resources (Healy and Thurston 2014; Powis 2004; Thurston 2011).

Finally, zooarchaeological analysis revealed some rare, and more exotic species, including the remains of stingrays and marine molluscs (Wagner 2009). These, and other fauna were likely used especially for ritual purposes (Pohl 1983; Wagner and Healy 2014). Marine shells were employed by the Pacbitun Maya for the manufacture of jewellery for personal adornment, as early as the Middle Preclassic Mai phase (Hohmann 2002, 2014; Hohmann *et al*. 2018). Several large marine bivalves of the spiny oyster (*Spondylus americanus* and *Spondylus pacificus*) have been found associated with elite burials and building caches (Bill 1987; Helmke *et al*. 2015). Five hollow, ground, polished, and carefully cut bone tubes (made from an assortment of artiodactyl remains, including peccary, brocket deer, and white-tail deer) were found in a royal tomb in Structure 1, and may have functioned as panpipes. Indeed, many different musical instruments have been recovered from Pacbitun, usually in elite or royal burials, and found as grave furnishings (see chapter eight, this volume; Cheong 2013; Cheong *et al*. 2014a, 2014b; Healy 1988; Healy *et al*. 2014; Healy *et al*. 2008b). Lastly, in addition to ritual items made from bone and shell, some animal bones were being carved into utilitarian artefacts (e.g., hairpins or weaving shuttles, needles, and beads) (Emery 2008; Healy *et al*. 2004c; Healy *et al*. 2014).

The bedrock geological formation here, as in much of Belize, is composed of a crystalline limestone of Cretaceous age. In Belize, this is labelled the Coban Limestone Formation (Hartshorn *et al*. 1984:62-63, Figure IV-6), which gave rise to the calcareous soils of the Northern Karst Foothill Ranges (Hartshorn *et al*. 1984:75-76, Table IV-5) of the region. These soils are good for subsistence farming, although not nearly as fertile as the alluvium of the nearby Belize River Valley, which appears to have attracted some of the very first Maya settlers (Cunil phase, ca. 1100-900 BC) of the eastern lowlands (Awe 1992; Healy 2006; Healy *et al*. 2004b:105; see also Pohl *et al*. 1996). In more elevated, and eroded, places around Pacbitun, the bedrock often lies only a few centimetres below the modern land surface. Long-term erosion of karst terrain surrounding Pacbitun, and limestone outcrops in the Mountain Pine Ridge, has created often deep, multiple chamber caves which were also exploited by the early Maya for ritual, short-term habitation, and other purposes (see chapter ten, this volume; Healy *et al*. 1996). Archaeological investigations of ancient Maya cave use in western Belize has been very insightful, demonstrating that some caverns were perceived as vital aspects of the sacred landscape (Awe *et al*. 2005; Graham *et al*. 1980; Healy 2007; Pendergast 1969, 1970, 1971, 1974; Prufer and Brady 2005; Spenard 2014).

Limestone was the primary building material for masonry architecture at Pacbitun, and elsewhere in the Maya lowlands. Plaster coatings (stucco) used to cover the buildings, architectural embellishments, plaza floors, and lengthy ritual roadways (*sacbeob*), were derived from the processing of crushed limestone. The latter stone was also quarried, carefully cut, ground, and worked into large monuments (stelae and altars), as well as various utilitarian implements, including maize grinding tools (manos, metates) spindle whorls, and bark beaters, all found at the site.

Outcrops of siliceous chert were exploited extensively by the ancient Maya for the raw material to manufacture sharp, chipped stone tools. These outcrops are known to exist in the Belize Valley (Ford 1991a, 2004; Ford and Olsen 1989; Whittaker *et al*. 2009) and further afield, in northern Belize (Hester and Shafer 1984; Shafer 1982; Shafer and Hester 1983). Verbal, and as yet unverified, accounts have been provided to suggest the presence of possible chert outcrops in the land immediately north of Pacbitun (Mayan Ranchos). Recovered chert artefacts occur in the form of knives, drills, projectile points, ceremonial blades, and choppers of various sizes at Pacbitun.

Granite, a valued geological material, was used for the manufacture of traditional Maya grinding stones, and can be found just to the south of Pacbitun in the Maya Mountains (Shipley 1978). Granite from this restricted, elevated area of Belize was shaped into implements found at a number of sites throughout the central Maya lowlands (Shipley and Graham 1987), and in considerable quantities at Pacbitun. In recent years, new evidence has helped to identify a granite groundstone workshop at the site, with ongoing technical analyses (see chapters fourteen and fifteen, this volume; Ward 2013).

Slate is another geological material that is particularly associated with Pacbitun. In fact, when first exploring the site in 1980, I was immediately struck by the abundance of slate debitage littering the modern surface. Excavations since then revealed that the Pacbitun inhabitants quarried slate in abundance in antiquity, perhaps from the vicinity of Slate Creek a few kms to the south, and produced an array of slate tools, ornaments, and jewellery (Healy *et al*. 1995). Excavation of an elite residential zone just off Plaza B (Structure 23) produced evidence of a small, attached, slate workshop (Bill 1987; Healy *et al*. 2004c:210-211; Lawrence and Pierce 2018). Of particular note from Pacbitun were several slate ‘wrenches’, and the repeated use of long, sawed slate slabs in the roofing of elite burials. Another artefact of particular interest, usually made in part of slate, was the polished, iron ore mosaic mirror (Blainey 2007; Healy and Blainey 2011). Both the drilled, round slate backings to these mirrors, and the polished pyrite polygons, have been recovered from multiple elite burials at Pacbitun, along with other slate artefacts (Healy *et al*. 1995).

Chronology

The chronological history of Pacbitun is based largely on the analysis of site ceramics, with close regional comparisons made to the established ceramic sequence of the nearby Belize River Valley (Awe 1992; Gifford 1976; Willey *et al*. 1965), bolstered by a suite of radiocarbon dates. From these data points, a six-period cultural chronology has been established. Refinements of the earliest and most recent portions of the sequence continue based on more recent explorations of the Preclassic deposits (see chapter one, this volume; Healy 1999; Healy and Awe 1995; Healy and Awe, eds., 1995, 1996; Hohmann *et al*. 1999). The chronological sequence originally established (Healy *et al*. 2004c:208) is as follows:

Time	Period	Phase
AD 600-900	Late Classic period	Coc and Tzib phases
AD 300-600	Early Classic period	Tzul phase
100 BC-AD 300	Terminal Preclassic period	Ku phase
300-100 BC	Late Preclassic period	Puc phase
900-300 BC	Middle Preclassic period	Mai phase

The Terminal Classic has been added, while Early and Late Classic dates have shifted slightly with new excavations and analysis (see Table 1.1 in chapter one, and chapter sixteen, this volume). While evidence for a terminal Early Preclassic period habitation, dating as far back as 1100 BC, now exists at the neighbouring site of Cahal Pech, and some associated Cunil phase sherds have been found at Pacbitun, in mixed deposits, none of these has occurred (so far) in a pure, stratified context (Awe 1992; Cheetham and Awe 1996; Healy *et al*. 2004b:104-110, Table 7.1). At the opposite end of the cultural sequence, site habitation ends at the close of the ninth century (ca. AD 900). At least one post-abandonment burial has been identified from the site, and some locally made moulded-carved pottery, but remnants from the Postclassic period are, so far, relatively rare at Pacbitun (see chapter sixteen, this volume).

Excavations of the Site Epicentre and Core Zone (1980-1997)

Pacbitun is a compact acropolis centre. The Core Zone is marked by five primary plazas (labelled A-E), surrounded by a variety of masonry structures atop a natural limestone hilltop that has been heavily modified by the early Maya (see Figure 1.2). Excavations between 1980-1997 tested both the plaza floors and the monumental structures in Plazas A, B, C and E, revealing a lengthy and complex site history.

Plaza A stands about 6 m above Plazas B-E, and serves as the most elevated level ground at Pacbitun. This plaza was the ritual and ceremonial heart of the site. Two of the largest and most elevated constructions at the site (Structures 1 and 2), a pair of stepped pyramids with (once vaulted) superstructures, face one another across the plaza. From atop Structure 1, it is possible to view the entire Core Zone, associated rural settlement, and even some valley ceremonial centres as much as 10 kms away.[3] Plaza A was also the locus of the majority of the 20 known Pacbitun stone monuments, including a stela-altar complex (Stela 4, Altar 2) situated in the centre of the plaza. Structure 1 appears even more massive in size as it is flanked by two smaller, adjacent, temple-pyramids, Structures 4 (to the north) and 5 (to the south). This configuration forms an E Group architectural complex (see chapter five, this volume; Aimers 1993; Aimers and Rice 2006; Ruppert 1940). The northern and southern sides of Plaza A are framed by two large range structures (Structures 3 and 6, respectively) with several associated stelae (or fragments thereof).

Plaza B is marked largely on its south side by a set of three enclosed courtyard groups, each surrounded on four sides by elevated multi-chambered range structures. This is, most likely, the royal residential zone of Classic period Pacbitun. One of these palatial ranges, Structure 23, was excavated by Trent, with continuing research of range structures in this area conducted more recently (see chapter six, this volume; Bill 1987). On the north side of Plaza B stands Structure 8, some 100 m long and about 8 m tall at its maximum. This enormous structure remains almost completely untested, but is known from our limited tests to be fronted on the south side by a wide stair. On the east side, Plaza B is bordered by the major temple-pyramid Structure 2, which straddles Plazas A and B.

Plaza C, the smallest open mall at Pacbitun at about 900 m^2, lies just west of Plaza B. Plaza D is the largest plaza at the site, measuring over 5500 m^2, and is situated north of Structure 8. It is marked by additional (likely administrative and residential) structures. Finally, just east of Plaza D is Plaza E, featuring especially the parallel, twin ranges of the ballcourt (Structures 14 and 15).

The Eastern Court lies northeast of Structures 1, 4, and 5 of Plaza A. It is a broad, elevated and flat area marked by seven range and pyramidal structures (Structures 34-40). Trent excavations were confined to Structure 38. Several of these structures have been tested more recently and the cluster labelled collectively as an 'Epicentre Residential Group' (see chapter eight, this volume; Cheong 2013).

Detailed description of the Trent excavations of the monumental architecture at Pacbitun conducted in the 1980s and 1990s have appeared elsewhere (Healy 1990a, 1992, 2014; Healy, ed., 1999; Healy and Awe, eds., 1995, 1996; Healy *et al*. 2004c). Below we highlight the early investigations and some of the major finds from the Trent work:

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[3] In 1995, while excavations were being conducted simultaneously at Pacbitun and Xunantunich, 15 kms to the west, was possible to see with the naked eye the blue protective tarp covering the Castillo (Structure A-6) at Xunantunich from the summit of Structure 1 at Pacbitun. Other valley centres might also be visible from primary architecture atop the highest plaza.

Plaza A

Structure 1

During the height of the Late Classic period, a time of significant site florescence, Structure 1 served as the most significant and imposing architecture at Pacbitun. The west face of Structure 1 measured 17.8 m wide. During the final stage (of the five major architectural phases identified so far), Structure 1 was marked by a large stair block carefully positioned midway up the broad, main, central stair. The stair block contained two caches and a pair of elite burials. On the final, plastered summit of Structure 1 stood a vaulted, single room, masonry building with a central doorway located in both the front and rear walls of the temple superstructure. The western door looked upon Plaza A, while the eastern door opened to the large (and, until recently, unexcavated) causeway Terminus Group labelled Structure 10 (see chapter thirteen, this volume).

Trent's excavation of Structure 1 included a large horizontal trench (10 m by 7.5 m) across the summit, which revealed the foundation and form of the final temple superstructure. Wall thickness and cut stone collapse materials suggest that the final Structure 1 temple had been vaulted (probably raising the height of Structure 1 to about 12.5 m from Plaza A to the temple building platform). Estimating the vaulted temple at 4 m tall, Structure 1 likely then stood at over 16 m in total height.

In addition to the summit area, a 4 m wide bisecting trench was dug down the west face of Structure 1, from the summit to the plaza. This trench cut as deep as 8 m into the heart of this massive structure, and exposed a series of earlier encased stairs, buildings, elite burials, and caches. The earliest architectural evidence identified so far dates to the Late Preclassic, with two further superimposed structures raised over this in the Early Classic, and two more in the Late Classic. Given the recent research of Plaza A (see chapters three and seven, this volume; Powis, ed., 2009, 2010, 2011, 2012, 2017, 2018; Powis *et al.* 2009), it is highly likely that some form of Middle Preclassic architectural remains lie buried below the unearthed Late Preclassic traces within Structure 1. However, in the late 1980s, concerns about structural instability and worker safety precluded any deeper tests.

Structure 1 contained the largest number of burials and caches (nine of each) of any building tested by us at Pacbitun. Several of the burials were of an extraordinary nature, with unusually large concentrations of mortuary offerings. Included among these was Burial (henceforth BU-) 1-7, containing two older adults (probably one male and one female), dating to the Early Classic Tzib phase, and the very elaborate burial of an adult male, a presumed Pacbitun ruler, recovered from the only vaulted, masonry tomb (BU 1-9) at the site, packed with elaborate grave furnishings, and dating to the Late Classic Coc phase (Healy *et al.* 2004a; Helmke *et al.* 2015). Most elite burials from Structure 1 contained concentrations of both plain and decorated ceramics, carved jade and shell jewellery, obsidian, chert, and even slate-backed pyrite mosaic mirrors (Healy and Blainey 2011; Healy *et al.* 2018; Robertson 2011). Burial types in Structure 1 included cists (3), crypts (5), and a lone, vaulted tomb (1). Several of the elite burials (BU 1-2, 1-3, 1-4, 1-8, and 1-9) were covered by long, cut, slate roofing slabs, while other graves (BU 1-6 and 1-9) had thick, layered beds of chert flakes covering them. Virtually all the burials (when discernible) had extended, dorsal burials with heads positioned to the south. Three of the elite burials contained an adult male and female pairing, a practice seen in burials from other Pacbitun monumental structures as well.

A pair of uncarved limestone monuments, Stela 1 and an accompanying circular Altar 1, were positioned to the west of Structure 1, at the base of the central stair, sometime in the final two centuries of the site's history. Three individuals (one male, one female, and a child) were buried beneath the base of Stela 1 and, likely, represent a human sacrificial offering associated with the erection of the monuments.

Structure 2

Although not quite as tall, Structure 2 directly faces Structure 1, and was another very significant Classic period edifice at Pacbitun, overlooking both Plaza A and the even larger, Plaza B, 6 m lower. Viewed from the west side, Structure 2 appears to be almost as tall as Structure 1 when the latter is viewed from Plaza A. The primary axes of Structures 1 and 2 align across Plaza A. Stela 4 and Altar 2 near the centre of this plaza were also positioned on this alignment.

Excavations in 1986 and 1987 cleared the eastern façade of Structure 2 in its entirety. As a result, we know that Structure 2, at its base, is about 25 m wide, with a nearly 6 m wide central stair. This work exposed five substructure architectural terraces, each about 1.5 to 2 m tall, rising to a substructure summit 7.2 m above the final plaza floor. With a superstructure in place, Structure 2 was likely over 11 m tall in the Terminal Classic. Like Structure 1, a large stair block marked Structure 2, though (unlike Structure 1) it contained no caches or burials. A vaulted, one room masonry superstructure was raised atop the building platform. There was a single doorway opening to Plaza A and probably (as with Structure 1) a similar, second doorway to the west, overlooking Plaza B (although the erosion of the backside of the summit leaves this open to question).

In addition to the extensive superficial exposure of the summit and eastern façade of Structure 2, a trench (2.5 m x 2 m) was sunk into the centre of the floor of the summit building to a depth of 4 m. This, and a series of smaller excavation probes below the central (east) stair, revealed at least four major structural phases for Structure 2, with the earliest assigned to the Late Preclassic, and the last construction occurring in the Late Classic Tzib phase. Structure 2 had excellent preservation of masonry architecture on the east face pertaining to the last centuries of the site history, which led to a major consolidation and reconstruction of the architecture by the Trent project. As was the case with Structure 1, it is quite possible that constructions pre-dating the Late Preclassic occur deeper within untested zones of Structure 2.

Significantly, Structure 2 produced the second largest number of elite burials at Pacbitun (five total). One of these interments, BU 2-1, contained the remains of an elite adult female with a remarkable array of Maya ceramic musical instruments and other artefacts (see chapter eight, this volume; Cheong *et al*. 2014a, 2014b; Healy 1988; Healy *et al*. 2008b). Grave types from Structure 2 included simple-pit urn burials (2), possibly sacrificial in nature, a cist (1) and crypts (3). Aside from the flexed juvenile urn burials, possibly offerings, all other individuals were adults with extended body positions and heads to the south (Robertson 2011: Appendix 1). Deep excavations beneath the front (east) stair of Structure 2 revealed the intentional burial (caching?) in antiquity of a large, full sized (but uncarved) limestone monument (Stela 10).

Structure 4 and Structure 5

These two major constructions on Plaza A symmetrically flank Structure 1, creating the triadic eastern portion of a classic E Group architectural unit. They were approximately the same overall size, about 16-18 m at the base, although Structure 4 was slightly taller (8.2 m) than Structure 5 (6.9 m) at the time of site abandonment. With superstructures, they likely stood about 12 m and 11 m respectively.

As with Structures 1 and 2, excavations here included clearing of the summits of both, with limited tests in the 1980s down the west face of Structure 5. A large, primary axis trench of the west face of Structure 4 was dug. On the basis of these excavations, both flanking structures appear to have started by at least the Late Preclassic period, with final renovations in the last stage of the Late Classic. Trent's excavations indicated that the two structures underwent at least five stages of construction and renewal. Both evolved from simple, low, flat-topped platforms, basically wing-like projections adjacent to Structure 1, into more elaborate, almost stand-alone temple-pyramids, with perhaps distinct identities later in their architectural histories. As with Structure 1, both of these temple-pyramids were marked by a single, frontal stair and, by the end of site occupation, a standing limestone monument located on Plaza A: Stela 3 in front of Structure 4, and Stela 2 in front of Structure 5. Clearing of the collapse area between, and in front of, Structures 1 and 4 in the 1990s revealed another fragmented monument, Stela 12, located west of, and between the two, on Plaza A.

Initial work into Structure 4 revealed three burials: two from the Late Classic period, and one post-abandonment grave. The former pair were crypts, while the latter grave was a simple pit. The Late Classic burials contained adult individuals who were positioned in extended positions with heads to the south. One (BU 4-1) contained a female, the other (BU 4-2) a male-female pairing. This crypt was also covered by slate roofing slabs. The post-abandonment grave contained a female in a flexed position. Two burials were recovered from Structure 5: BU 5-1 was a crypt with an adult male in an extended, dorsal position, with head to the south. The other grave (BU 5-2), a simple pit, had fragmentary skeletal remains which could not be identified to gender. Body position and head orientation were also unclear.

Stela 2 was positioned in front of the west central stair of Structure 5, while Stela 3 was positioned, similarly, in front of the west stair of Structure 4. Recently, excavations of Structure 5 were renewed (see chapters five and nine, this volume; Micheletti 2016).

Plaza B

Structure 8 and Sub-Structures B1 to B5

In 1987, a 2 m x 3 m test excavation was begun in Plaza B, just to the south of this massive range structure, which is oriented east-to-west. The test (located at the base of Structure 8, near the southeast corner) exposed the six lowest steps of what is evidently a massive, structure-wide stair. However, excavations here were important not only for uncovering well-preserved remains of a wide stair to Structure 8, but also the first indications of the very early stratigraphic history of Plaza B. The excavation revealed the relatively shallow presence of rich, and well-preserved Middle Preclassic deposits directly in front of Structure 8, which was certainly a Classic period construction in its final stages. Several adjacent excavation lots probing Plaza B (just south of Structure 8) produced stratified quantities of Middle and Late Preclassic sherds, altered marine and freshwater (*jute*) shell, animal bones, and a rich, black midden deposit covering traces of several of the earliest examples of platform architecture at Pacbitun. The latter became the focus of Trent investigations in 1995 and 1996 (Healy and Awe 1995).

A large (> 50 m^2) exposure into the flat, open area of Plaza B revealed the first clear evidence of foundation walls belonging to multiple, quadrangular shaped structures (originally of pole-and-thatch) of Middle Preclassic date. These stone foundation alignments served as edging to very low, earthen mounds which rest almost directly on bedrock. At least five buried structures (labelled Sub-Structures B1 to B5) were identified, along with six additional stone alignments (suggesting more platforms and constructions). Based on ceramic analysis and careful radiocarbon dating, these humble structures (thought possibly to be shell workshops and/or residences) were all part of a small, Maya farming village dating to the early and late facets of the Middle Preclassic period (Hohmann and Powis 1996, 1999; Hohmann *et al*. 1999; Powis *et al*. 2009). These earliest structures at Pacbitun were all covered by a thick (100 cm+) midden-like deposit, laid down sometime after the Middle Preclassic period.

The earliest architectural remains (Mai phase, 900-600 BC) unearthed here rose only about 10-15 cm above site bedrock. The presence of postholes, marked by soil discolourations inside the wall space, suggested that these low, stone-edged platforms once supported perishable structures of pole-and-thatch. On at least one occasion, these postholes contained what appear to be offerings of drilled, marine shell beads. Floors to these structures were hard-packed earth and marl. After about 600 BC, these earliest structures (Sub-Structures B1 to B4) were abandoned, and then partly covered by another generation of simple Preclassic architecture (Healy 1999: Table 1; Powis *et al*. 2009).

The late Middle Preclassic structures (Sub-Structures B2, B3, and B5), by contrast, were more substantial, often consisting of as many as three courses of cut limestone blocks (25 cm high) built directly over the initial early Middle Preclassic structures. These newer edifices were not only more elevated and larger in size, but were oriented differently than their predecessors. One of these platforms (Sub-Structure B2) was likely over 60 m^2 (see chapter three, this volume).

There was an abundance of whole and fragmentary freshwater *jute* snails (*Pachychilus sp.*), with a smaller number of pearly mussels (*Nephronaias sp.*) and apple snails (*Pomacea sp.*), found near these Middle Preclassic structures, suggesting the importance of certain molluscan species for Maya subsistence at this early date (Healy *et al*. 1990; Moholy-Nagy 1978; Powis 2004). In addition, marine shells, in the form of both shell debitage and shell disc beads in various stages of production, as well as small chert drills, were represented. The vast majority of Middle Preclassic shell beads from Plaza B (and adjacent Plaza C) were derived from floor deposits, structural and construction fill, and building perimeter deposits of these Preclassic structures. Hohmann (2002: Table 7.1; Hohmann *et al*. 2018) has analysed this shell industry in detail, and reports that only a tiny proportion is associated with ritual activity (burials, caches, or special deposits). She has reconstructed, and described in detail, Preclassic shell ornament production at Pacbitun, examining both finished and unfinished shell artefacts, and demonstrated increasing bead uniformity (standardisation) over time. The shell bead household (or cottage) industry revealed at Middle Preclassic Pacbitun is some of the oldest evidence for both personal adornments, in the form of simple shell disc beads, and for Maya artefact production (Healy *et al*. 2014; Hohmann 2002, 2014; Hohmann *et al*. 2018). Powis and his team have renewed investigations of Plaza B with excellent, and confirming, results (see chapter three, this volume; Crow 2018; Crow and Powis 2021).

Structure 23

This large range constituted part of an elite residential quadrangle, and larger royal compound, on the south side of Plaza B, and called the Palace Group. In its final architectural stages, Structure 23 possessed at least a partial, multi-room masonry superstructure, with benches and spine wall. These were built atop a roughly 4 m tall substructure with, in its final stages, wide stairs on both the north and south sides. The structure was excavated extensively in 1986 (Bill 1987; Healy 1990a:253-254; Healy 2014:13-14; Healy *et al*. 1995:343-344).

Structure 23 is the northernmost of four ranges that enclose a small, private plazuela (Court 2). In its final form, Structure 23 was about 23 m long by 7 m wide. A thick dividing (spine) wall, running east-west, covered the length of the range. The absence of equally thick, exterior building walls suggests that the lower half of the Structure 23 superstructure may have been built of masonry, while the upper half was probably made of timber and thatch.

Excavations involved a total clearing of the summit of Structure 23, followed by deep trenching on the north and south faces, and a deep central trench. These three operations, taken to bedrock, revealed at least six major stages of construction and renovation, and many subphases of modification and renewal. Structure 23 began, simply enough, on a low Late Preclassic base (atop the midden covering Plaza B sub-structures), with signs of the range form clearly evident by at least the Early Classic (possibly earlier). The low plastered platform of the more substantial masonry construction, with a marked increase in size and height, dates to construction during the Coc and Tzib phases of the Late Classic period. The superstructure became taller, and increasingly more complex, through time. It is interesting to note that Structure 23, while evolving, provided easy access, via doorways, between the north and south sides (from Plaza B to Court 2) in the Late Preclassic and Early Classic periods. However, construction of a solid spinewall along the full length of Structure 23, and a slate workshop annex on the west end of the range, would have markedly disrupted or even blocked such easy pedestrian movements in its later history of use.

By AD 700, Structure 23 possessed the architectural features and design normally associated with Classic Maya 'palaces', with lateral chambers on each side of the spinewall dividing the north and south faces of the range. Some of these rooms (north side) contained low plastered benches. At about AD 700-900, during the final stage of construction, the plazuela south of Structure 23 was a very secluded, and private courtyard for the elite quadrangle occupants. It was also during the final stage that the passageway between Structure 23 and adjacent Structure 29 was almost totally closed by the addition of a small auxiliary building, labelled Structure 23-Annex, which proved to be a slate workshop. The attached workshop edifice contained slate debitage and stacks of slate slabs used at Pacbitun for elite burials. By the end of its occupation, Structure 23 likely served multiple functions: an elite family residence, administrative-public service hall, and elite craft production site, involving slate in this case, perhaps all connected with the kin-related elite families inhabiting the palace quadrangles just south of Plaza B. There were no burials associated with Structure

23, but there were several building caches unearthed, and a rich Middle-to-Late Preclassic midden beneath the palace complex. Excavations of the Palace Group on the south side of Plaza B have been renewed recently (see chapter six, this volume; Cherico and Skaggs 2018; Lawrence and Pierce 2018; Pierce and Skaggs 2018; Skaggs *et al.* 2017b).

Plaza C

Clearing of Plaza C in 1995 revealed several large fragments of a broken, limestone monument (Stela 13). Excavation around (and under) this monument base, still in position, failed to recover any associated cache. However, the same excavation accidentally unearthed remains of a grave (BU-C1). Based on associated sherd ceramic types, the poorly preserved, flexed burial dated to the Middle Preclassic period. The remains belonged to an adult individual (sex indeterminate) with the head positioned to the west (Arendt *et al.* 1996:130-134, Figure 1). Until recently, these were the earliest human remains recovered from Pacbitun.

Plaza E

Structures 14 and 15

A nearly identical pair of parallel, range structures was situated just north, and below, Plaza A, and served as the main architecture of the Pacbitun ballcourt (Healy 1992). The mounds measured 17.5 m x 13 m, and stood 3.5 m tall. In 1984, and three years later, searches were made of the playing alley for signs of a ballcourt marker, without success. In 1987, the summit and east face of Structure 14 was tested, while larger excavations were ongoing of adjacent (and better preserved) Structure 15. All indications are that the construction of the two ranges was done simultaneously, and that the mounds were mirror images of one another in size, form, and architectural changes (Figure 2.1). The summit of Structure 15 was cleared horizontally with a large 7 m x 2.5 m excavation. This revealed the presence of a building platform, but virtually no evidence for a masonry superstructure. Given the presence of the platform itself, however, some type of perishable superstructure most likely had originally existed. After summit clearing, a 3 m x 2 m excavation was begun in the top centre of the range, with bisecting trenches (each 3 m wide) extending down the primary axis, from the top of Structure 15 to the base, on both the east and west faces. These excavations revealed four major phases of excavation, with numerous minor modifications and phases of rebuilding (Healy 1992). Included in these subphases were unusually frequent, and often generous, replasterings of the range surfaces. The concentration of stucco work was particularly evident on the playing alley and sloping bench face, the bench top, and the major angled surface of the playing wall.

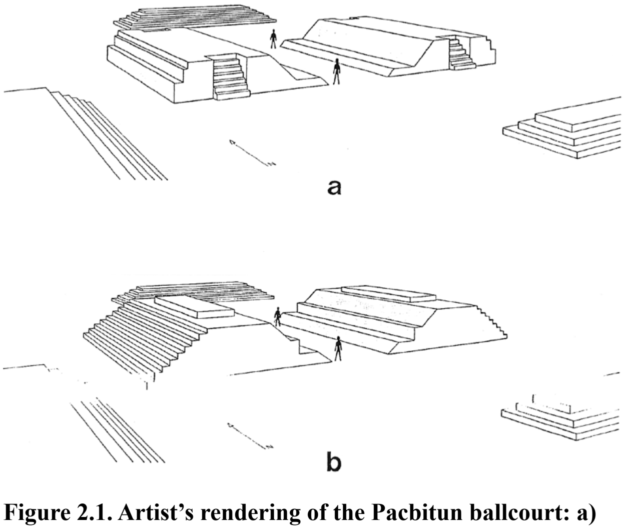

Figure 2.1. Artist's rendering of the Pacbitun ballcourt: a) Late Preclassic; b) Late Classic (after Healy 1992: Figure 8).

Initial construction of Structures 14 and 15 was during the Late Preclassic period, with multiple stages of resurfacing in the Early Classic period. The smooth, hard, plastered slope of the playing wall was painted bright red at this time. An elaborate Early Classic offering (Cache 15-1) was unearthed on the east side of Structure 15. The cache contained a green obsidian bipoint/knife from central Mexico, a finely made, stemmed, plano-convex point of chert, almost certainly from the workshops of Colha (Belize), a polished hardstone (basalt?) celt, as well as a jade bead, likely from southern Guatemala, a bone stingray spine (*Rajiformes*), fitting valves of a spiny oyster (*Spondylus americanus*) from the Caribbean Sea, six shell and slate carvings (so-called 'Charlie Chaplin' figures) and over 180 unaltered shells of the local freshwater snail *jute* (*Pachychilus indiorum*). All these curious items were neatly encased within two Early Classic ceramic vessels of unusual form, placed lip-to-lip as a ballcourt offering (Healy 1992:233-234, Figures 5-7).

Later constructions to the ballcourt ranges in Plaza E altered the playing wall angles during the Late Classic period. In the final stage, there are traces from a pole-and-thatch superstructure on the summit. In the final Terminal Classic stage, evidence of range stairs was recovered, along with a low building platform, presumably with what had once been a timber superstructure. The ballcourt at Pacbitun remains one of the earliest open-ended courts known from the Maya Lowlands. The court is also especially interesting because of its documented architectural evolution, over six centuries at least, showing marked changes in form and size. The Early Classic cache provides clear evidence for Pacbitun's wealth, and long-distance trade and contacts, at this early date.

Eastern Court

Structure 38

This structure was a prominent raised platform belonging to the North Group (Structures 34-40) of the Eastern Court. Excavations were conducted here in 1987. The structure measured 8 m x 6 m, and was 1.2 m tall. It was the smallest structure tested by the Trent project in the Core Zone. Structure 38 was in use in the Late Classic, and went through at least two major architectural phases. The evidence was insufficient in 1987 to determine the building function. The platform was likely once topped by a pole-and-thatch superstructure. While no burials or caches were uncovered at the time, more recent investigations of the mounds located on the Eastern Court have revealed a very lengthy history and signs of a residential role (Cheong 2013). Included in several North Group burials was further evidence for the ritual importance of musical instruments at Pacbitun (see chapter eight, this volume; Cheong *et al.* 2014a, 2014b).

Monuments of Pacbitun

The Lowland Maya began erecting stelae (possibly with painted decoration) as early as the Late Preclassic period to honour and aggrandize site rulers and their dynasties (Hammond 1982). Flat, pedestal-like altars, often paired with stelae, are abundant throughout the Classic period at major sites in the Maya Lowlands (Clancy 1985), and both types of monuments occur at Pacbitun.

The Trent investigations have revealed the remains of at least 20, largely fragmentary, stone monuments, including 13 stelae and seven altars (Table 2.2). All but one were made of limestone; the exception being made of a dense, dark volcanic stone (possibly an andesite or meta-andesite). In general, the monuments were in poor condition. Most of the stelae (10/13) and altars (4/7) were positioned on Plaza A, reinforcing the prominence of this area in the history of the site. Three monuments (Stela 6, Altar 3, and Altar 4) have carved decoration. The presence of these monuments, all located in the Epicentre of the site, suggests that Pacbitun had a well-established elite class, with dedicated monuments, and indicates that the site and its royalty played a prominent role in the eastern region of the Maya Lowlands in the Classic period. Of the monuments which could be dated, eight appear to have been raised or positioned during the last half of the Classic period (either the Coc or Tzib phases, ca. AD 550-900), with several others most likely dating to the Coc phase. Three others (all with remnant traces of carving) belong to the Early Classic period (Tzul phase, AD 300-550). At least five monuments, for now, have an unknown age assignment, due to poor stratigraphic information, though surely falling within the Classic period.

Only Stela 6 had recognisable traces of a Long Count date (Healy 1990b). The badly shattered, irregularly shaped, 2 m tall limestone stela was found lying with the carved front face up, atop the final floor of Plaza A. There are signs that this is a secondary (not primary) location for the monument;

Table 2.2. Monuments (stelae and altars) of Pacbitun.

Designation	Plaza/Location	Dimensions (L x W/cm)	Date
Stela 1	Plaza A/ W front of Str. 1	383 x 107	LC- Tzib
Stela 2	Plaza A/ W front of Str. 5	260 x 106	LC-Tzib
Stela 3	Plaza A/ W front of Str. 4	228 x 110	LC-Tzib
Stela 4	Plaza A/ centre of plaza	369 x 126	LC-Tzib
Stela 5	Plaza A/ SW side of Str. 3	190+ x 95	?
Stela 6*	Plaza A/ W of Stela 2	190+ x 150	EC-Tzul
Stela 7	Plaza A/ NE side of Str. 6	82+ x 82	?
Stela 8	Plaza E/ SE side of Str. 13	262+ x 118	LC-Coc?
Stela 9	South of Plaza A/Tzul Causeway	310 x 70	LC-Coc
Stela 10	Plaza A/ below Str. 2 stair	176+ x 118	
Stela 11	Plaza A/ S front of Str. 3	204+ x 100	
Stela 12	Plaza A/ between Strs 1 & 4	250+ x 157	?
Stela 13	Plaza C/ W end of plaza	fragmented	LC-Tzib
Altar 1	Plaza A/ with Stela 1	125 x 92	LC-Tzib
Altar 2	Plaza A/ with Stela 4	110 x 180	LC-Tzib
Altar 3*	Plaza A/ within Str 1	120+ x 130+	EC-Tzul
Altar 4*	Plaza A/ within Str. 2/Cache 5-2	72 x 62	EC-Tzul
Altar 5	Plaza E /S of Str. 14	159 x 116	LC-Coc?
Altar 6	S of Plaza A/Tzul causeway	168 x 164	LC-Coc?
Altar 7	Plaza E/ with Stela 8 & Str. 13	95+ x 95+	LC-Coc?

* carved
LC –Tzib = Late Classic period (AD 700-900); LC-Coc = Late Classic period (AD 550-700);
EC –Tzul = Early Classic period (AD 300-550)
All known Pacbitun monuments were made from crystalline limestone, except for Stela 9, which may be composed of either andesite or meta-andesite.

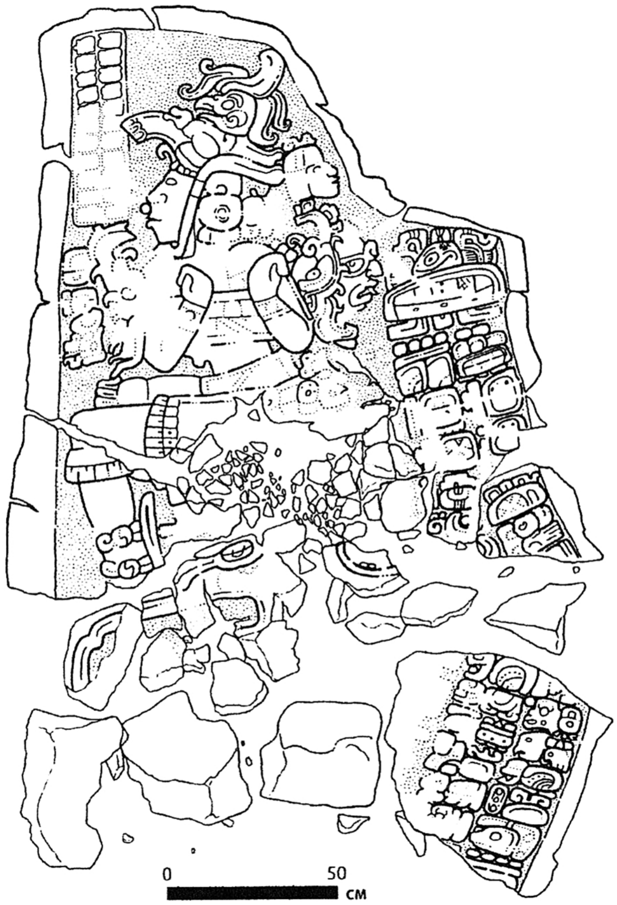

Figure 2.2. ***In situ*** **drawing of Pacbitun Stela 6 (fragments conjoined) (after Helmke** ***et al.*** **2006: Figure 2).**

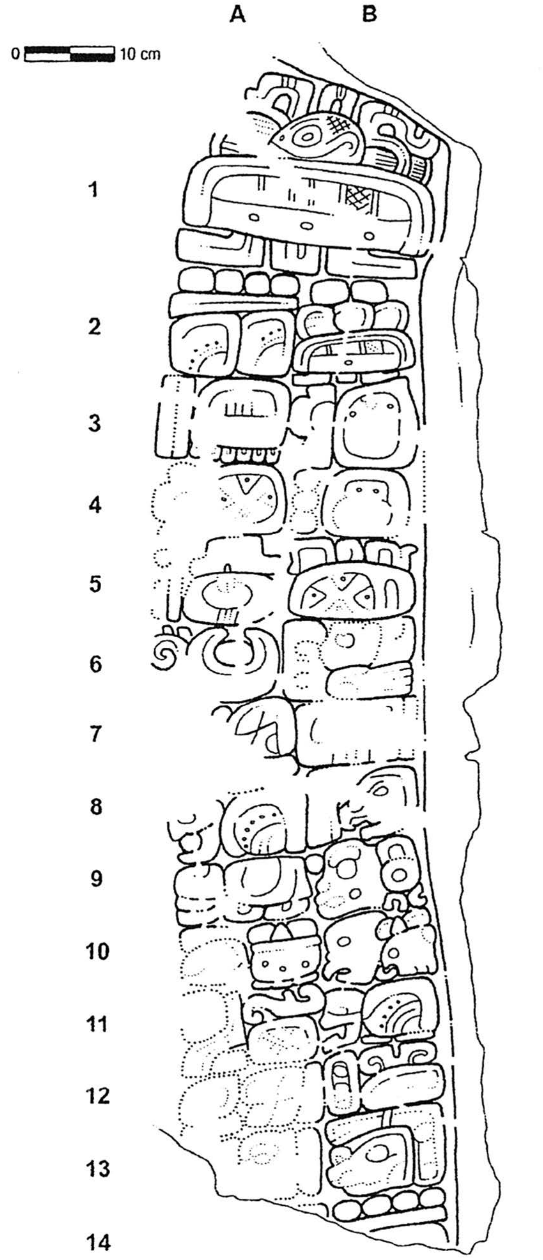

Figure 2.3. Drawing of principal hieroglyphic text of Pacbitun Stela 6 (with fragments conjoined) (after Helmke ***et al.*** **2006: Figure 5).**

no base was located. Despite being fragmented, the low relief composition of the stela could be reconstructed due to the articulated condition of the pieces (Figure 2.2). The scene is dominated by a seated personage, presumably a Pacbitun ruler, holding a ceremonial bar with reptilian heads at each end. The individual, elaborately attired with a large earspool and other globular jewellery (likely representing jade), wears an elaborate headdress. Part of this is decorated with a (mammalian) animal skull topped by a crested bird (perhaps a currasow or turkey, remains of which are known from the site). The nosebead, worn by the central personage, is typical of Early Classic royal regalia. Helmke and colleagues (2006:74) have suggested that this is a scene of royal investiture and accession at Pacbitun.

The stela has a vertical glyph column on the upper left corner. Another, more elaborate text, which begins with an Initial Series Introducing Glyph (ISIG), and a bar-and-dot Long Count date, is situated just behind the seated central figure (Figure 2.3). Although the entire inscription is not well preserved, an initial reading of the calendrical units suggested a date of ca. AD 475. Recent investigations have provided a more detailed description of the monument iconography and a Long Count date of 9.2.10.0.0 (3 Ajaw 8 Kumk'u), or March 22, 485 (Helmke *et al.* 2006). This reconstructed date makes Pacbitun Stela 6 one of the earliest Maya monuments known today, again hinting at the early prominence of Pacbitun in the Upper Belize Valley or beyond.

The main fragment of Altar 3 was recovered buried deeply within Structure 1, in architectural deposits also dating to the Early Classic period. Approximately 40 percent of the lower portion of this pedestal altar is preserved and is elaborately carved (Figure 2.4). The original altar shape resembled a rounded square. The imagery is enclosed within an incised quatrefoil frame, similar to Early Classic altars found at the sites of Copan (e.g., the Motmot marker; Sharer and Traxler 2006: Figure 7.24), Caracol (e.g., Altar 13; Beetz and Satterthwaite 1981; Chase and Chase 1996; Chase and Chase, eds., 1994), and elsewhere. The scene

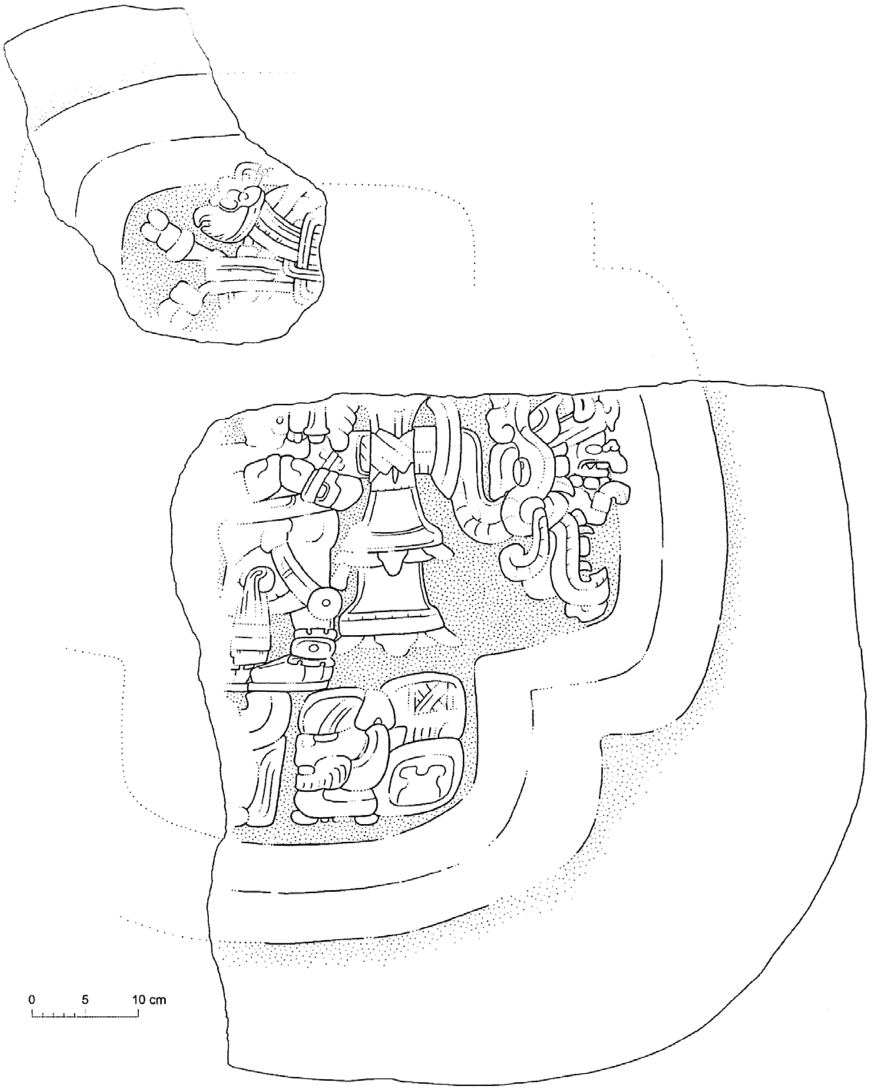

Figure 2.4. Drawing of Pacbitun Altar 3 (two fragments) (after Skaggs *et al.* 2017a: Figure 4).

on Pacbitun Altar 3, which is only partially visible in the fragment, shows the lower portion of a standing elite (likely royal) figure in a typical Early Classic period pose (Proskouriakoff 1950:19-21, Fig. 17, Type 1A1-a). The belt assemblage is visible, with a pendant chain hanging behind the central figure's heels. This is reminiscent of ornate belt chains on Early Classic monuments at Uxbenka (Stela 11) and Tikal (Stela 35) (Skaggs *et al.* 2017b: Figure 6). A bicephalic ceremonial bar is also visible in the scene. Only two glyphs appear below the feet of the standing figure. At least one of these may be a toponym, and likely the ancient place name for Pacbitun (Helmke and Awe 2008:73-74). The altar design and figural decoration fit comfortably into an Early Classic style (Flora Clancy, personal communication, 1988; Skaggs *et al.* 2017b:118-120). Considering the date of Pacbitun Stela 6, it is conceivable that these two carved monuments originally served as a stela-altar pairing (Healy 1990b; Skaggs *et al.* 2017b:120). Interestingly, recent investigations of the courtyards south of Plaza B have unearthed another carved fragment of Altar 3 that had been repositioned by the Pacbitun Maya to the Plaza B royal residential group and reused in antiquity (see chapter nine, this volume, Skaggs *et al.* 2017b:120-121).

Altar 4 was recovered from within Cache 5-2 of Structure 5. It is composed of three fragments, which were found together, but not in an articulated state, atop a set of slate slabs. Two of the three fragments had shallow, but clearly intentional, grooves on the upper face. At least one of these grooves likely once encircled the original, complete altar stone. The carving on Altar 4 is rudimentary compared with Altar 3 and Stela 6. In some ways, Altar 4 looks more like a smaller, likely circular, disc-shaped ballcourt marker, rather than a larger pedestal-style plaza altar. A reconstructed size is approximately 72 cm x 62 cm; it was only about 15 cm thick.

Investigations of Settlement and Population Estimates

Based on the success of Willey's pioneering Maya settlement research in the nearby Belize Valley, and a number of other archaeological studies in the decades that followed (Hammond 1981; Willey *et al.* 1965), Trent

University initiated a detailed investigation of ancient Maya settlement at Pacbitun. In the 1980, 1984, and 1986 field seasons the Pacbitun Periphery Zone (surrounding the Epicentre and Core Zone) was marked largely by a heavy forest cover. In order to determine the distribution and form of ancient, outlying local habitation, the density and spacing of settlement, and an estimate of population size, a programme of mapping and test excavation of housemounds surrounding Pacbitun was initiated in 1986. Initially, due to the dense vegetation, four identical, radiating transects, each extending out 1 km from the site centre, were established. These radiated diagonally from the Core Zone (instead of along cardinal directions) in order to cross-cut a range of different micro-environments, and to gain a more representative picture of ancient Maya settlement diversity in the periphery of the site. The methodology used was based on similar transect studies at other Maya centres such as Tikal (Puleston 1983), Uaxactun (Puleston 1974; Ricketson and Ricketson 1937), Tikal-Sacnab (Ford 1986, 1991a; Rice and Rice 1980, 1990) and Xunantunich (Ashmore *et al.* 2004; Neff *et al.* 1995). Detailed descriptions of the Pacbitun transect surveys can be found in Richie (1990) for the eastern transect pair, and Sunahara (1995) for the two western transects. Summaries of this transect settlement data have been published by Healy *et al.* (2007:22-24).

In the last half of the 1987 summer season, an opportunity arose to enlarge the settlement study. Fortuitously, large-scale land clearance for agriculture and grazing, and the availability of a well-equipped professional survey team, enabled acquisition of more complete settlement information from the previously unexplored areas between and adjacent to the four radial transects, extending from the Core Zone (Figure 2.5). Detailed description of this 'total coverage' quadrant survey, covering 1 km^2, can be found in Campbell-Trithart (1990) and summarised by Healy (*et al.* 2007:24-26). An advantage of the complete, pedestrian survey of the four quadrants, which overlapped in part with the earlier transects, was that it exploited the vastly improved land visibility. Secondarily, it also enabled a comparison of the accuracy of the transect results, conducted under conditions of more impaired visibility (Healy *et al.* 2007:26-28). The conclusion was that while transects are a reasonable and efficient method for settlement study in areas of dense forestation (see Plog *et al.* 1978) they can lead to oversight of some smaller mounds (in our case, about 26 percent of the mounds). This compares closely with a similar comparison study conducted in a re-survey of areas around Tikal (Culbert *et al.* 1990:116), where 25 percent of the transect housemounds were missed. Transect surveys, by themselves, likely underestimate mound counts, and related population estimates generated from these.

The results of the combined transect and quadrant surveys resulted in the field identification of 330 mounds. Just over half of these (n=171, 51.8 percent) were solitary mounds, or what Willey *et al.* (1965:561) termed 'ordinary' mounds. The balance of mounds (n=159, 48.2 percent) were clustered around small plazas in groups of 2-6 mounds each. In these patio-groups, the average number of mounds (of all sizes) was about three. With only a few exceptions, all of the largest groups (those with 4-6 mounds each) occur within 250 m of the Epicentre of Pacbitun. These structures were divided into five size categories based on estimated basal dimensions: very small (10-20 m^2) = 7.6 percent; small (21-40 m^2) = 37.2 percent; medium (41-70 m^2) = 30.9 percent; large (71-100 m^2) = 13.2 percent; and very large (> 100 m^2) = 11.1 percent. Excluding the 'very large' category of mounds, wherein a small number of clearly oversized mounds would significantly skew the overall results, the average size of the basal area of transect mounds was 48.6 m^2 ('medium'). There was almost no difference in average mound size between the four transects. Average basal size of mounds in the quadrants was a close 44.4 m^2. The 'very large' mounds (averaging 112.5 m^2 in the transects, and 180 m^2 in the quadrants) may represent higher status (but non-royal) residential structures (Healy *et al.* 2007:28-29). Analysis of the distribution of mounds revealed that mounds of all sizes in the periphery occur in greater abundance and density in the initial 250 m of the transect units, closer to the Core Zone, than in the final 250 m of the transects (in the Periphery Zone). There is a gradual 'fall off' in mound density as one proceeds away from the Epicentre. In general, this is similar to the concentric zonation model developed from settlement data at Tikal (Arnold and Ford 1980), with only high-ranking persons living closest to the Epicentre, and lower-ranking residents living further away. However, there is a considerable number of mounds of mixed sizes throughout the 9 km^2 than might be expected under a strict zonation model. This seems to suggest, at least at Pacbitun, a less segregated socio-political system was in operation by the Late Classic period.

The impression is that this steady decline in visible mounds becomes more marked beyond 2 kms from the site. Mounds have been recognised, in unsystematic surveys, as far as 4 kms west of Pacbitun (on the outskirts of the modern Maya village of San Antonio-Cayo) and to the north at a similar distance. The nearest ancient Maya centres are Macaw Bank, Guacamayo, and Tipu-Negroman, about 8.2-9.9 kms west of Pacbitun (Graham *et al.* 1985), and Xualcanil, about 6.9 kms to the northwest (Iannone 1996, 1997; Iannone and Connell 2003). Therefore, the midway points between Pacbitun and neighbouring centres are about 3.5-5.0 kms which, on the basis of cursory surface reconnaissance, may be the outermost edge of the Pacbitun territory or realm. In sum, our initial settlement study (1986-1987) generated a conservatively estimated site size of 9 kms^2, but future surveys of more distant regions around Pacbitun could raise this total area and, therefore, the number of mounds and overall population size (Healy *et al.* 2007:29).

As part of the settlement study at Pacbitun, an estimate was also generated of at least 25 possible elite-class 'residential' structures (as contrasted to temple-pyramids, ballcourts, and others) located within the Epicentre during

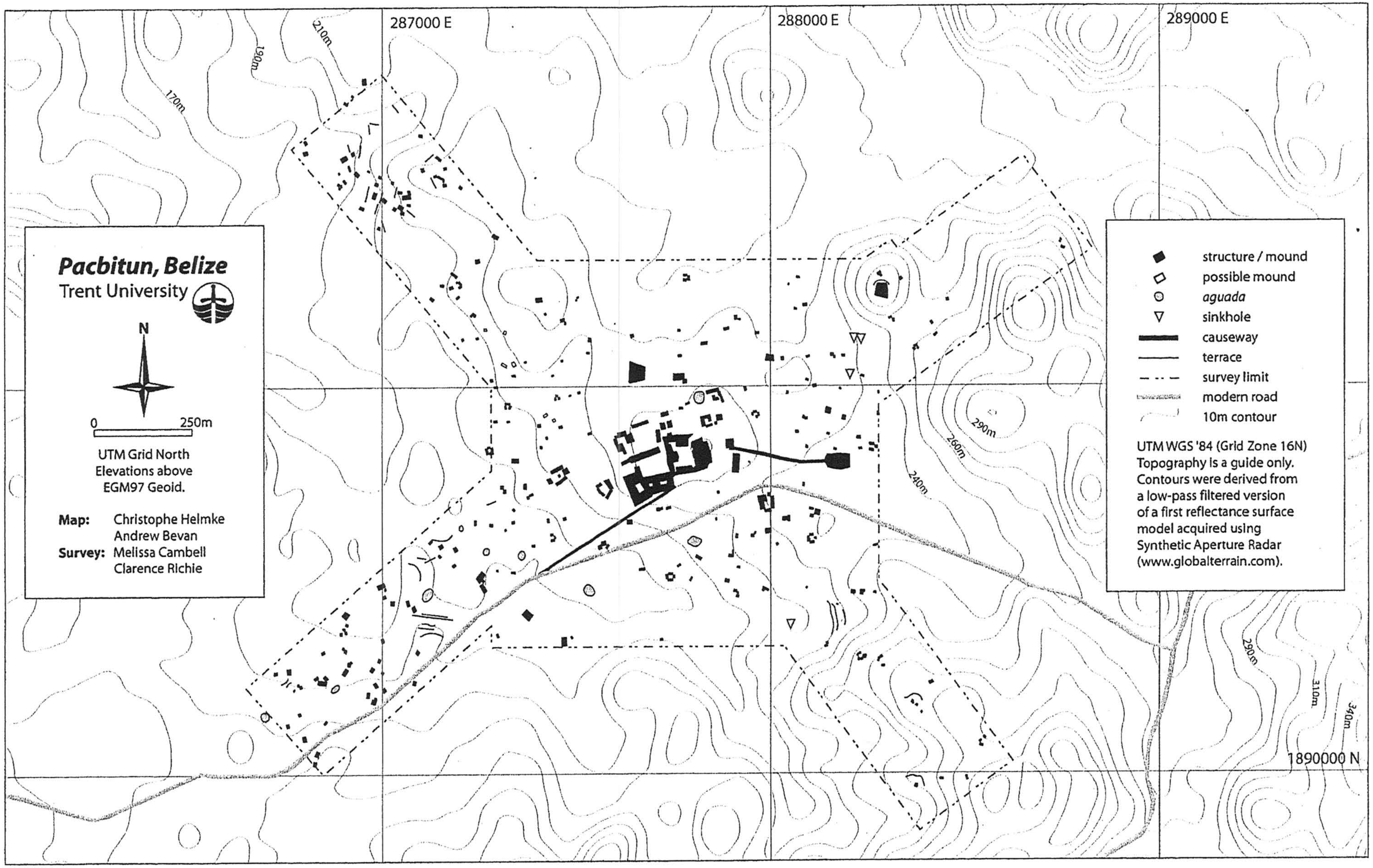

Figure 2.5. Map of the Pacbitun settlement survey (Epicentre, Core Zone, and Periphery Zone) (after Healy *et al.* 2007: Figure 3).

Table 2.3. Population estimates for Pacbitun (by period) (after Healy et al. 2007: Table 3).

Period/Phase	Periphery %	Core (%)	Epicentre*	Total (A)**	Total (B)***
Late Classic (Tzib) (AD 700-900)	5632 (100)	1018 (100)	200	6850	5377
Late Classic (Coc) (AD 550-700)	1718 (30.5)	51 (5)	53	1822	1430
Early Classic (Tzul) (AD 300-550)	760 (13.5)	102 (10)	26	888	697
Late Preclassic 620 (11) (Puc/Ku) (300 BC-AD 300)	51 (5)	20	691	542	
Middle Preclassic (Mai) (900-300 BC)	0 (n.d.)	0 (n.d.)	16-49	25	20

* The Tzib phase Late Classic Epicentre population estimate, based on elite residential (palace) structures, represents 3 percent of the combined Periphery and Core Zone population (unadjusted). This same percent is used for all earlier periods except the Middle Preclassic Mai phase, for which independent architectural evidence is limited.

** Total (A) calculation assumes 100 percent occupation, and all mounds being residential.

*** Total (B) is calculated with a residential rate of 78.5 percent (reducing the population estimates by 21.5 percent). In this adjustment of the raw population count (Total A), 10 percent is added to count for various hidden structures, but 31.5 percent is deducted to account for the possibility of non-contemporaneous mounds, a non-residential function for some mounds, and for disoccupation (after Culbert *et al*. 1990:115).

the Late Classic period (Tzib phase only). Most of these elongated, ‘range’-type masonry buildings at Pacbitun are in a series of elite residential compounds on the south side of Plaza B (Structures 7, 9, and 22-33), on the Eastern Court northeast of Plaza A (Structures 35-37 and 40-41), and on Plaza D (Structures 17 and 19-20). In the greater Maya area, most of these larger, palatial structures are marked by their symmetry, spine walls, and presence of rooms (Christie 2003b). Extensive excavation of one such ‘range’ building at Pacbitun (Structure 23) revealed a Late Preclassic period start, with multiple renovations and expansions, as might be expected for residences (Bill 1987). Many of these palace-like structures also have accessory living space in the form of small private courtyards, providing secluded compounds for members of the royal family. Structure 23 at Pacbitun also provided evidence for an attached craft workshop associated with manufacturing of slate goods. Based on the spatial analysis of the Epicentre, and the estimate of eight per range structure (derived from the six rooms, three benches, and 80 m^2 of space in Structure 23), a total of 200 elite persons (belonging to the royal court) was generated for Pacbitun in the Late Classic period (Table 2.3) (Healy 2007:38). That represents about 3 percent of the site population for this time period (see below). Adams (1974:294) provided a calculated guess of 150-200 persons (< 2 percent of total population) for Uaxactun, and 400-800 persons for the much larger site of Tikal (< 1.5 percent of the total population). Tourtellot (*et al*. 2003:97) estimated 2 percent of the population of La Milpa represented the aristocratic population that controlled ‘top level and external affairs’ in the central 1.5 kms^2 of the site (see chapter six, this volume).

While the calculation of prehistoric population sizes for sites is difficult, reasonable estimates can be generated based on the number of housemounds, and excavations which provide evidence (especially from ceramics) for the age (and length of occupation) of these residential structures (Becquelin and Michelet 1994; Ford 1991b; Rice and Culbert 1990:14). From the 330 identified housemounds, a sample of 74 structures (22.4 percent) was excavated. Correcting for possible ‘deranging factors’ (such as ‘invisible mounds’, non-residential mounds, etc.), overall population estimates, by chronological period, were generated (Table 2.3).[4] Assuming a 100 percent occupancy of housemounds in the Late Classic (Tzib phase), we estimated the Epicentre population at 200 persons, the Core Zone at 1018 persons, and the Periphery Zone (the surrounding 8 kms^2) as 5,632 persons, for a total of 6,850 persons for the entire site realm (Healy *et al*. 2007:31-33, Table 3). Estimates by period show a steady increase in site population through time, with a particularly pronounced rise between the Early and Late Classic periods (from about 900 persons by AD 500 to almost 7,000 by AD 900).[5] Virtually every mound tested by excavation (in the Core Zone and Periphery Zone) showed signs of Tzib phase occupation. By zones, 82 percent of the population resided in the periphery by the time of collapse, 15 percent in the central area (Core Zone), and a very restricted 3 percent (about 200 persons) in the Epicenter.

It should be noted that it was during this time of marked architectural growth and population maximum that evidence for agricultural intensification, in the form of hillslope terracing, occurs on both the north side of the

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[4] A calculation for the Epicentre has already been described. A separate population calculation which incorporates settlement data from transects and quadrants provides a mounds per km^2 estimate. We then assumed each mound represented a dwelling unit inhabited by 5.5 persons (a widely accepted multiplier in Maya demographic calculations; see Kolb 1985:586-590; and Rice and Culbert 1990:18).

[5] Other researchers have employed different occupancy or ‘residential’ rates. Kurjack and Garza 1981:304 use 90 percent for Dzibilchaltun and the Northern Maya Lowlands, while Culbert *et al*. (1990:115) suggest a ‘residential rate’ of 78.5 percent for the mounded structures mapped at Tikal. This more conservative multiplier would lower the total population estimate for Pacbitun to 5,377 persons in the Late Classic (Tzib phase).

Belize Valley (Fedick 1994:124), and on the south side, in places like the periphery of Pacbitun (Healy *et al.* 2004c:221). The adoption of terrace agriculture in the Periphery Zone may be evidence of an attempt by the Pacbitun Maya to conserve and improve farmland, and satisfy their growing subsistence needs in the face of a rapid population expansion (see Boserup 1965, 1981). In the end, despite these efforts, the societal response appears to have failed and Pacbitun underwent a late 9th century collapse (White *et al.* 1993). It seems likely that the growing subsistence needs outstripped the agricultural productivity of the site by the end of the Classic period (Johnston 2003). The final radiocarbon date recorded for a cache within the summit of Structure 1 at Pacbitun is AD 820-900 (Healy 1990a: Table 1).

Final Remarks

Large-scale archaeological investigations at Pacbitun, undertaken over many years, have helped to document the site history and architectural evolution, including evidence in the site periphery for a farming population and agricultural intensification in the form of hillslope terracing. From these early, Trent University investigations of all three zones (Epicentre, Core, Periphery) of the site, it is now clear that Pacbitun was first inhabited as a small village during the Middle Preclassic period, starting about 900 BC, in the strategic location which would become the ritual and political focus of a significant Classic period Maya centre. Even at this early date, the site inhabitants were involved with long-distance trade and craft specialisation. It is also now clear that Pacbitun holds a wealth of valuable new information dealing with the earliest stages of growing Maya social and political complexity (Brown and Bey 2018; Powis, ed., 2005). Pacbitun then grew, and flourished, during the Late Preclassic period, with some of the first large-scale masonry architecture appearing along with a major reconfiguration of Core Zone site planning and architecture. Dynastic rule is evident at Pacbitun by at least the Early Classic period based on a pair of carved monuments dedicated to site rulers here. However, Pacbitun reached its apogee during the succeeding Late Classic period. Judging from both the quantity and scale of monumental building, and creation of monuments, the site florescence occurred in the final phases of the Late to Terminal Classic period (AD 550-900), when it likely served as a regional civic centre located along the southern rim of the Belize Valley, with a population numbering, probably at a minimum, about 6,000 persons. The rulers of Pacbitun of this era oversaw religious and political activities, while being well housed and maintained, and given royal burials at the time of their demise. Importantly, there are few signs of habitation here after the regional collapse of the Maya about AD 900 (Iannone 2014; Iannone *et al.* 2016).

During its remarkable, 1800-year history of settlement, the Maya population of Pacbitun spread across the forested landscape, farmed their lands, sometimes intensively, and made considerable use of their natural environment, while simultaneously trading, near and far, with their Pre-Columbian neighbours. They exhibited notable resilience across centuries of environmental, social, and political change. For almost two millennia, this medium-sized regional centre prospered and grew until its late 9th century demise. Now, ongoing and new archaeological investigations, discussed at length in this volume, insures that a much more complete picture of the complex evolution of this significant lowland Maya city will emerge as we enter an exciting new era of research.

Acknowledgements

Investigations at Pacbitun by Trent University were made possible by generous grants to PFH from the Social Sciences and Humanities Research Council (SSHRC) of Canada, and Trent University. Permission to excavate at Pacbitun was granted by the Belize Institute of Archaeology, under the direction of several Archaeological Commissioners, and by the property owners, especially Alfonso Tzul and his extended family. The author would also like to acknowledge and thank the many undergraduate and graduate students of Trent University, many of whom are cited in this chapter, for their interest, diligence, and hard work between 1980-1997. Of particular importance, based on their dedicated, long-term assistance to the research at Pacbitun are Dr. Jaime Awe (Northern Arizona University) and Dr. Terry G. Powis (Kennesaw State University). I need to thank Doreen, Kristen, and Eric Healy for their support, encouragement, and patience during the decades of research in Belize. The work at Pacbitun would not have been possible without this, and I shall always be grateful. Finally, I wish to acknowledge the dozens of Belizean workers (mostly from the communities of San Antonio, San Ignacio, and Succotz, Cayo District) who played a crucial role in seeing these investigations to fruition. While there are too many to name here, individually, their collective efforts and skilled labours on behalf of Belizean archaeology are a tribute to each of them. I remain grateful for all they taught me about Belize and Maya archaeology.

3

Middle Preclassic Maya Community Organisation at Pacbitun, Belize

Terry G. Powis

The ancient Maya site of Pacbitun had a long sequence of occupation, spanning 1800 years. Archaeological investigations over the past four decades has provided significant insight into the rise and fall of this medium-sized site located to the south of the Belize River Valley. The focus of this chapter is on the diachronic development of Pacbitun throughout the Middle Preclassic, from its humble beginning as a small farming community ca. 900 BC through to its rise as one of the preeminent regional civic-ceremonial centres ca. 400/300 BC. The information gathered from Pacbitun offers insight into the cultural trajectory of the early Maya in this part of the lowlands. Few sites in the region can offer as much information, mainly due to the fact that at Pacbitun PRAP has uncovered, in a horizontal fashion, both domestic and non-domestic architecture and associated features. As such, we are able to reconstruct Maya life on a scale not observed before for the Middle Preclassic. Our research shows how connected Pacbitun was to the Belize Valley, but also to far distant regions such as the Peten of Guatemala and beyond.

Tracing its cultural trajectory in the Middle Preclassic allows for a better understanding of how the site grew to become a major Classic period site. In its apogee during the Late Classic (AD 550-800), Pacbitun had to navigate its relationship(s) with sites to the north (in the Belize Valley), to the south (in the Vaca Plateau), and to the east (Peten of Guatemala). Maintaining those socio-political and economic connections that were originally built in the Middle and Late Preclassic periods were necessary for its Classic period success. Only by thoroughly understanding the nature, extent, and structure of early Maya life at Pacbitun can we explain its later role elsewhere in the eastern Maya lowlands.

Terminal Early Preclassic (1200-900 BC)

The Belize River Valley is one of the earliest known settled regions in the Maya lowlands. Archaeological investigations at Blackman Eddy (Garber *et al*. 2004a; Garber *et al*. 2004b), Cahal Pech (Awe 1992; Cheetham 1998; Sullivan and Awe 2014; Sullivan *et al*. 2009; Sullivan *et al*. 2018), and Xunantunich (Strelow and LeCount 2001) show that each site was originally occupied during the terminal Early Preclassic. The local ceramic complexes, termed the Cunil and Kanocha phases at Cahal Pech and Blackman Eddy, respectively, date from 1200-900 BC. Pacbitun does not seem to have been permanently occupied until the subsequent Middle Preclassic (Healy 1990a, 2014; Powis *et al*. 2009; Powis *et al*. 2017). Moreover, it is quite possible/reasonable to suggest that these first Pacbitun inhabitants came from the Belize Valley, located only 18 kms away, and that settlement at Pacbitun may have been directly related to population growth, and an ongoing Preclassic process of settlement fissioning (Powis *et al*. 2009:170). Under such a scenario, Maya colonists, following settlement of the most productive river bottomlands by the tenth century BC, had then begun to infill available, adjacent lands.

At Pacbitun, approximately 300 sherds have been identified as being Cunil (Powis *et al*. 2009:170). Despite the presence of Cunil sherds at the site, all of them are derived from mixed deposits. No stratigraphically sealed Cunil phase deposits have been found to date (Healy *et al*. 2004a; Powis *et al*. 2017). Despite this, there may be a small, still unrecognised, Cunil phase settlement at or near Pacbitun. It is hoped that future research will shed some light on the earliest pottery and habitation at Pacbitun, and that the results will impact the growing evidence for initial colonisation of the Belize Valley.

At Pacbitun, the earliest evidence for occupation dates to the Middle Preclassic, which Healy (1990a) defined as dating from 900-300 BC. The Middle Preclassic was identified locally as the Mai phase, and is comparable ceramically to the Jenney Creek phase at Barton Ramie (Gifford 1976). Throughout the 1990s, archaeological investigations in the site core were able to further refine the Mai phase into an early facet (900-600 BC) and a late facet (600-300 BC) (Healy 1999; Hohmann and Powis 1996, 1999; Hohmann *et al*. 1999). The early and late facets are based on both ceramic crossties with other valley sites like Barton Ramie (Gifford 1976) and Cahal Pech (Awe 1992) and radiocarbon dates obtained from stratigraphic contexts in Plaza B in the site core. Four radiocarbon dates fell between 620-450 cal BC (905-375, 2 sigma, 95 percent probability) and, according to Healy *et al*. (2004a:224), not only securely set the date for initial habitation of Pacbitun but also enable a division of the Mai phase into early and late facets. Mai phase pottery at Pacbitun has been found in numerous sealed deposits associated with both early and late Middle Preclassic architecture.

Middle Preclassic Period (Mai Phase 900-300 BC)

The earliest demonstrated evidence for occupation at Pacbitun occurs nearly three centuries after the Belize

Valley is initially settled. At this time, the site is isolated from other sites in the region. There is no archaeological evidence of any early Middle Preclassic occupation within 9 kms of Pacbitun. The closest sites are located in the Belize Valley, some 9-18 kms away to the west and north of the site.

The founding families of Pacbitun decided to settle at the foothills of the Maya Mountains. Within 4 kms of the site, there are a number of perennial rivers, creeks, and springs, which may have first attracted these people to the area. The Macal River, located 4 kms to the west, would have connected the early inhabitants of Pacbitun directly to the Belize Valley, providing access to goods and information. The significance of the location of the original settlement may have been due to the abundant resources that the Maya Mountains had to offer, including pine, slate, and granite (Healy 1990a, 2014). Although an economic reason is plausible for the settling of Pacbitun, the presence of dozens of caves within the area also lends credence to its founding for religious/ritual purposes (see chapter ten, this volume).

Early Mai Phase

Plaza B

Initial settlement at Pacbitun occurred in Plaza B. In 1987, Healy (1990a: 2014:11-12) placed a 3 m by 2 m excavation unit at the base of Structure 8 on the Plaza B side. His investigations revealed a rich, black midden deposit that covered what he believed were the earliest examples of platform architecture dating to the Middle Preclassic. During the mid-1990s, archaeological excavations were conducted at Pacbitun by the Trent University Belize Valley Preclassic Maya Project, (BVPMP) directed by Paul Healy. As part of a three-year (1995-1997) project, investigations were placed only in those areas where Middle Preclassic deposits had been encountered in the mid-1980s (Healy 1999; Healy and Awe, eds. 1995). Plaza B was specifically targeted for this investigation.

From our horizontal excavations in Plaza B we have been able to reconstruct the earliest settlement at Pacbitun. Around 900 BC, bedrock in Plaza B was scraped, filled, and levelled in order to prepare the surface for the first domestic constructions at the site. In 1997, excavations revealed an undulating bedrock, with some crevices reaching nearly 5 m deep (Hohmann and Powis 1999:23-25; see also Skaggs *et al.* 2015). These crevices were infilled with alternating layers of soil and marl by the early inhabitants. Based on BVPMP and PRAP investigations, three low earth-and-stone constructions (Sub-Structures B1, B4, and B16), sharing the same shape, size, and height (Figure 3.1), were excavated in Plaza B (Crow and Powis 2021; Powis *et al.* 2019a). The houses, although not completely exposed, measured roughly 8 m long by 4.5 m wide by 10-15 cm high. To construct the platforms the Maya used small, roughly hewn limestone blocks cut to similar size. The single-wall stone foundations were apsidal in shape and two courses high. The cut stones measured 20-30 cm long, 10-15 cm wide, and 5-8 cm thick. Each building was aligned northeast-southwest, with an orientation of 20-25 degrees east of north. The floor surface of each platform was capped with a 2-3 cm thick layer of white marl. Evidence of postholes penetrating the floor (and bedrock) indicates that each apsidal platform exhibited a perishable superstructure (Figure 3.2). An alleyway, measuring about 1 m wide, separated each platform from one another. The houses appear to be laid out in a grid pattern, uniformly aligned with designated space between each house.

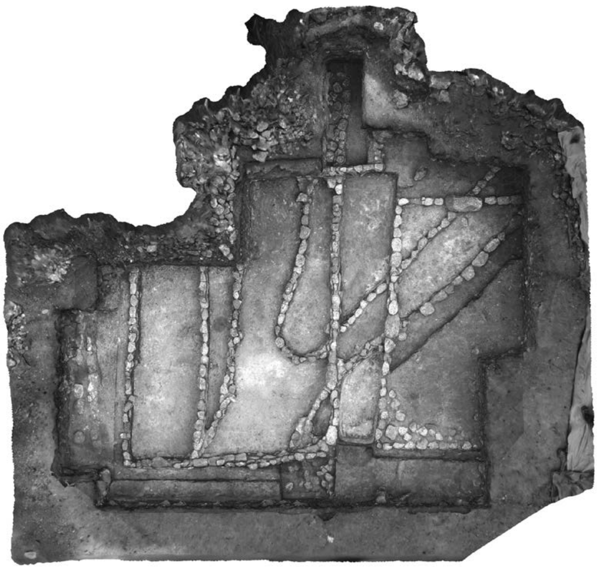

Figure 3.1. Photogrammetry of Sub-Structures B-1-B-4 and B-16 in Plaza B (Photo courtesy of Andrew Vaughan).

Throughout the early Mai complex, the pottery assemblage from the three houses in Plaza B had been relatively homogeneous and dominated by only two groups (Figure 3.3), Jocote (69%) and Savana (30%). These two ceramic groups account for almost 100% of the total early Middle Preclassic assemblage (Crow and Powis 2021). Within these two groups of pottery, all varieties identified by

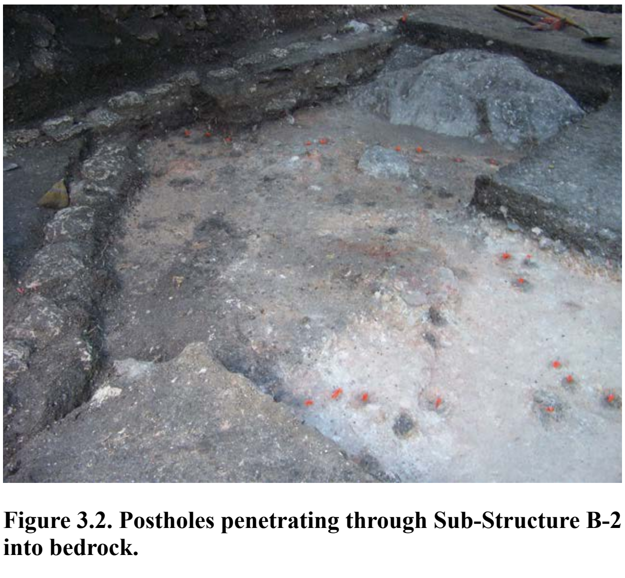

Figure 3.2. Postholes penetrating through Sub-Structure B-2 into bedrock.

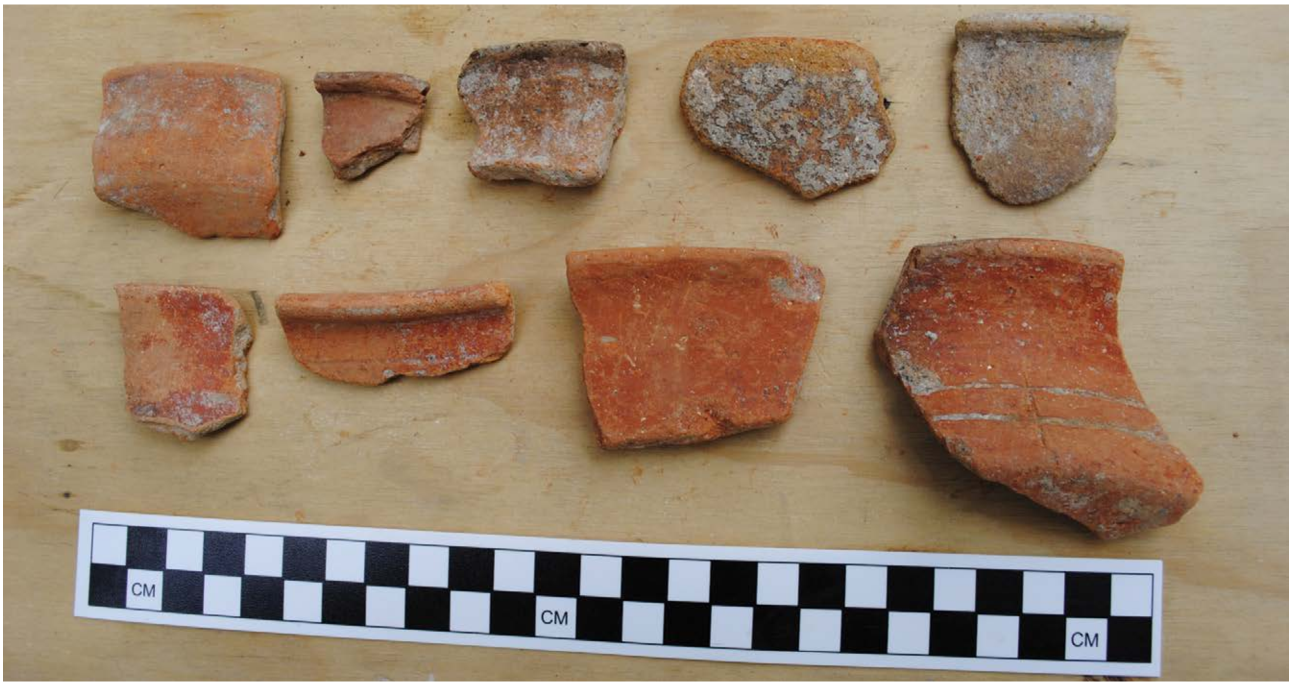

Figure 3.3. A representative sample of Reforma Incised: Mucnal Variety sherds from early Mai contexts in Plaza B at Pacbitun. The three sherds on the right side of the top row belong to the Jocote Group.

Gifford (1976) at Barton Ramie were present in the Pacbitun sample. The remaining portion of the early Mai assemblage is mostly made up of Joventud (0.08%) and Chunhinta (0.06%). The early Mai sherds are typologically very close to the Jenney Creek phase material at Barton Ramie (Gifford 1976) and the early Kanluk phase material at Cahal Pech (Awe 1992). In support of the ceramic dating, there was a single radiocarbon date, cal BC 800-770 (Beta B-93778), which was obtained from below the floor of Sub-Structure B1 (Healy 1999:70, 74; Powis *et al*. 2009:172), located just above bedrock, confirming the temporal assignation of all three platforms to the early Middle Preclassic period (Hohmann and Powis 1999:8).

Local products made from slate (drilled pendants) and granite (manos and metates) were found in all three early Mai houses. There is also considerable evidence for long-distance exchange at this early time, with greenstone, obsidian, and marine shell being imported into the site (Powis *et al*. 2017). By far the most prominent nonlocal artefacts are irregular and discoidal beads made from marine shell (Figure 3.4). A total of 624 shell beads (complete and broken), 423 pieces of marine shell detritus (representing all parts of the shell), and 33 chert microdrills (intact and broken) have been recovered from both inside and along the outside perimeter of the houses (Crow and Powis 2021; Hohmann 2002; Hohmann *et al*. 2018). Combined, the shell assemblage strongly indicates shell working activities were nucleated in Plaza B and organised at the household level (Hohmann 2002). Shell beads, shell detritus, and chert microdrills were found embedded in the floor of each house. This indicates that the Maya, like the Zapotec at San Jose Mogote and Tierras Largas in the Valley of Oaxaca (Flannery and Winter 1976:39; Pires-

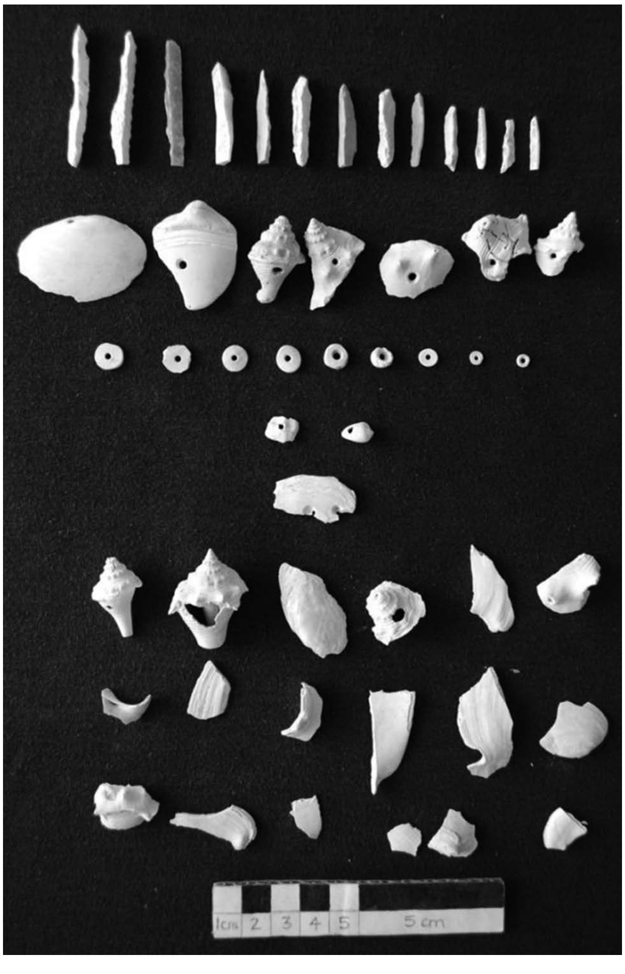

Figure 3.4. A representative sample of marine shell beads, marine shell detritus, and chert microdrills from around the perimeters of Sub-Structures B-1 and B-4. Photo courtesy of Terry G. Powis.

Ferreira 1976, 1978), were likely living in the same space they were crafting shell beads. As observed at San Jose Mogote, space in each early Mai house was partitioned between living quarters and shell working. We see no evidence that one platform was used separately for day-to-day activities and another for shell working activities.

Given the density of production debris, these were likely household producers, either on a full-time or part-time basis, that were manufacturing beads for other members of the community and/or for export – possibly to the Peten of Guatemala. Despite the inland location of Pacbitun, it appears that the marine shell, especially conch (Strombidae) was preferred by the early Mai inhabitants of the site. These shells were brought to Pacbitun from the Caribbean Sea, a distance of 110 km away. The shells were most likely transported by canoe up the Belize River (Powis *et al*. 1999), but overland routes cannot be discounted. Our understanding of how these shells moved by river or land remains unclear. Presumably, it was down-the-line trade as there are a number of other Middle Preclassic valley sites overlooking the Belize River with evidence of shell bead production, including Blackman Eddy (Cochran 2009), Cahal Pech (Awe 1992; Healy *et al*. 2004c; Horn 2015; Powis 1996), Chan (Keller 2008, 2012; Robin 2012), and Lower Dover (John Walden, personal communication, 2019). To be clear, with initial settlement at Pacbitun, these early settlers began a practice of manufacturing marine shell beads from shells that they could only obtain from a great distance. The sustained relationship(s), whether economic or political, with other sites along the Belize River endured over multiple generations.

Evidence for ritual activity associated with the apsidal houses in Plaza B is limited. There are a handful of solid-clay figurine fragments found in and around the apsidal houses, but few found *in situ*. Typically, the figurine heads, and sometimes a torso or appendage, are found in secondary midden contexts. The presence of greenstone triangulates provides some additional evidence for ritual activity as they have been associated with shamanic divination rites (Powis *et al*. 2016; Tate and Reilly 1995; Thomson 1987). Furthermore, we have found one offering dating to the early Middle Preclassic period. The cache, Cache 1, consisted of 51 irregular-shaped marine shell beads found stacked together, in a posthole along the northern wall of Sub-Structure B1 in the plaza. According to Hohmann *et al*. (2018:136), the arrangement of beads suggests that they may have been strung together at the time they were deposited.

Court 2

In 2017, as part of PRAP's investigation into the three Classic period elite residential courtyards at the southwest end of the site (south of Plaza B), Court 2 was selected for excavation in order to further corroborate and clarify the chronology of events in the courtyards of Pacbitun first established by Bill (1987). It was also intended to provide representative artefact densities for comparison to similar units excavated in Courts 1 and 3 (see chapter six, this volume). A single unit (17-B-CT2-1) measuring 3 x 3 m was placed into the centre of the plaza in Court 2. A total of three plaster floors were identified, each dating to the Classic period (Skaggs and Cherico 2018). Under the lowest floor was a thick 15-20 cm layer of black soil containing numerous artefacts, including ceramics, lithics, shells, charcoal, and animal bones. Below this midden layer, one stone alignment was discovered. The stone alignment was slightly curved. Ceramics from the inside of the wall indicated a Middle Preclassic date of construction.

Intrigued by the curved nature of the sub-plaza alignment, in 2018 PRAP went back and placed a large L-shaped unit, measuring 11 m by 8 m, over the western half of the plaza in Court 2. The intent was to expose as much as possible of the curved alignment to see if it formed another apsidal platform similar to those identified in Plaza B. Exposure of the alignment revealed one of the largest round platforms discovered in the Maya area dating to the Middle Preclassic period. Designated as Sub-Structure C2, the round platform measures 12 m in diameter (Figure 3.5). It was erected directly on bedrock, which had been levelled like the surface in Plaza B. In fact, the apsidal platforms in Plaza B were at the same elevation (227 MASL) as Sub-Structure C2 in Court 2. Sub-Structure C2 consisted of seven courses

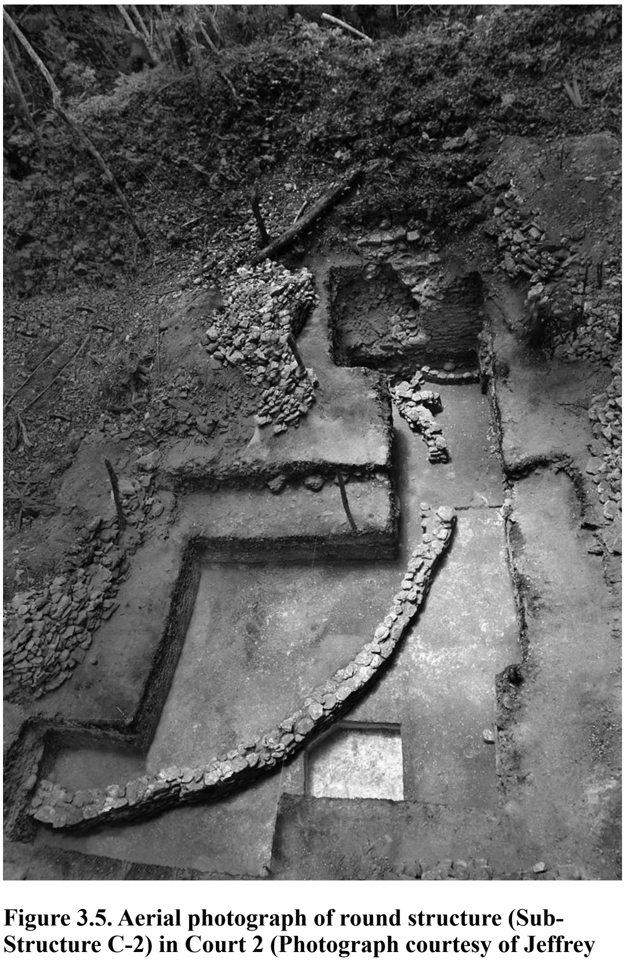

Figure 3.5. Aerial photograph of round structure (Sub-Structure C-2) in Court 2 (Photograph courtesy of Jeffrey A. Powis).

of finely-cut limestone blocks, with a height of 55 cm above bedrock. The wall of the platform was two courses wide, an arrangement unique to Court 2. The cut limestone blocks were slightly larger than in Plaza B with an average length of 20-45 cm, 15-22 cm wide, and 5-10 cm high. The surface of the round platform consisted of a tamped layer of thick 3-5 cm white marl. No postholes were found on its summit indicating an open-air platform. The plaza surface around the perimeter of the round platform also consisted of a tamped white marl. Like the floor of the platform, the plaza surface was twice as thick as that observed on and around the apsidal houses in Plaza B. The tamped marl plaza surface encircled the round platform, but did not continue underneath it, indicating that the round platform was laid down first. A number of the cut limestone blocks used in the construction of Sub-Structure C2 were burned but no identifiable pattern was discerned.

Dating of the round platform is based on ceramic material and known architectural characteristics of the period. The overwhelming majority of sherds (Jocote Orange-brown: Jocote Variety and Ambergris Variety, Chacchinic Red-on-orange-brown: Chacchinic Variety, Savana Orange: Rejolla Variety) collected from inside the round platform belong to the Savana and Jocote Groups (Gifford 1976) indicating an early Mai date, likely near the end of the phase (700-600 BC). Architecturally, the most important trait that indicates this round platform pre-dates 600 BC is the presence of tamped marl surfaces. At Pacbitun, we know that lime-plastered plaza surfaces that have been dated radiometrically do not occur until after 600 BC. The combined evidence strongly indicates an early Mai phase date for Sub-Structure C2.

The apsidal house platforms in Plaza B and the round platform in Court 2 are therefore contemporaneous in date. But why are they separated? Why different shapes? And, did these platforms serve different functions? We think that this is indeed the case. The house platforms are a distance of 50 m due north of the round platform. We are unsure why the round platform is constructed to the south of the domestic houses, but its location may have been planned/designed due to the nature of the topography at that end of Plaza B. Bedrock falls off in three directions (east, west, and south). In essence, the round platform is situated on the highest point. It is 50 cm higher than Court 1 and 4-4.5 m higher than Court 3. Viewed from these directions, Sub-Structure C2 becomes a focal point for the entire community—prominently isolated from the low residential platforms to the north in Plaza B. The shape of the round platform also sets it apart from the other (apsidal) platforms. Sub-Structure C2 is made with larger and better-faced limestone blocks. The round platform is twice as high and wide as its apsidal counterparts. The summit floor of the round platform and the surrounding plaza floor are twice as thick as the surfaces of the apsidal houses. There are no postholes on its summit signifying it was an open platform, possibly for performative purposes (Aimers *et al*. 2000; Powis 1996). If this is the case, then the round structure served a public ceremonial function that is different from the domestic houses in Plaza B. Dating to 700-600 BC, Sub-Structure C2 is considered to be the first public ceremonial construction at Pacbitun.

The ceramics associated with the round platform consist of the same types and forms of the pottery derived from the apsidal houses in Plaza B, but the execution is better. Additionally, some of the round structure ceramics have decorative elements (e.g., vertical and horizontal geometric patterns) on exterior surfaces not observed on any of the other pottery (Figure 3.6). Furthermore, the highest density of exotic material (greenstone, obsidian) is found

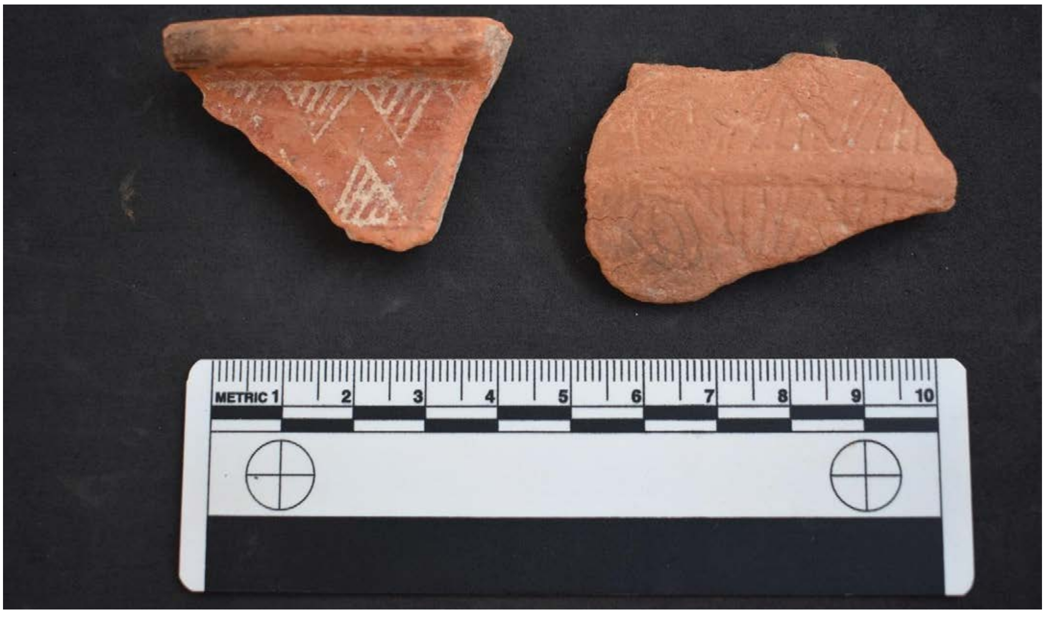

Figure 3.6. Two Reforma Incised: Mucnal Variety sherds with triangles derived from the perimeter of Sub-Structure C-2 in Court 2.

around the perimeter of the round platform; however, this does not include the presence of marine shell beads like those found in Plaza B. Surprisingly, only a few pieces of marine shell, bead or otherwise, were found in our Court 2 investigations.

In 2018, we found our first Middle Preclassic burial at Pacbitun placed on the outside of the southern edge of Sub-Structure C2. The individual lay on the white tamped plaza surface in an extended, prone position, with head to the south. The burial was not placed in a pit or stone-lined cist but lay seemingly exposed outside of the round platform. No grave goods were found but two small slate slabs covered the head. No skeletal analysis has yet to be undertaken but its short stature, about 1 m in length, indicates that this individual may have been a juvenile.

Late Mai Phase

Plaza B

Located immediately above the early Mai houses were the architectural remains of at least five late Mai (or late Mamom) house platforms (Sub-Structures B2, B3, B5, B11, and B13) dating to 600-300 BC. The late Mai configuration of houses differed drastically in orientation and form from the early Mai designs (Figure 3.7). By 600 BC, we see a dramatic shift from the construction of apsidal-shaped houses to rectangular and square shaped ones. These late Mai platforms were built directly over the top of the early Mai ones, with limestone blocks touching each other from different phases, maintaining this preferred location for the next three centuries. The overall architectural orientation changed as well to 20 degrees west of north, which aligns much more east-west than the northeast-southwest orientation observed in early Mai times. The late Mai platforms, like their predecessors, were aligned adjacent to one another with 1 m wide alleyways between them. The presence of alleyways between the platforms indicates the houses were associated and contemporaneous in nature. Based on the presence of postholes, late Mai platforms supported perishable, wattle-and-daub structures. They stood three courses high (measuring 25-30 cm) and one course wide, except on the corners where they were two-three courses wide. The stones used in the construction of these buildings were better faced and slightly larger than their predecessors measuring 20-40 cm by 15-30 cm and standing 8-10 cm high. Floor surfaces were only identified

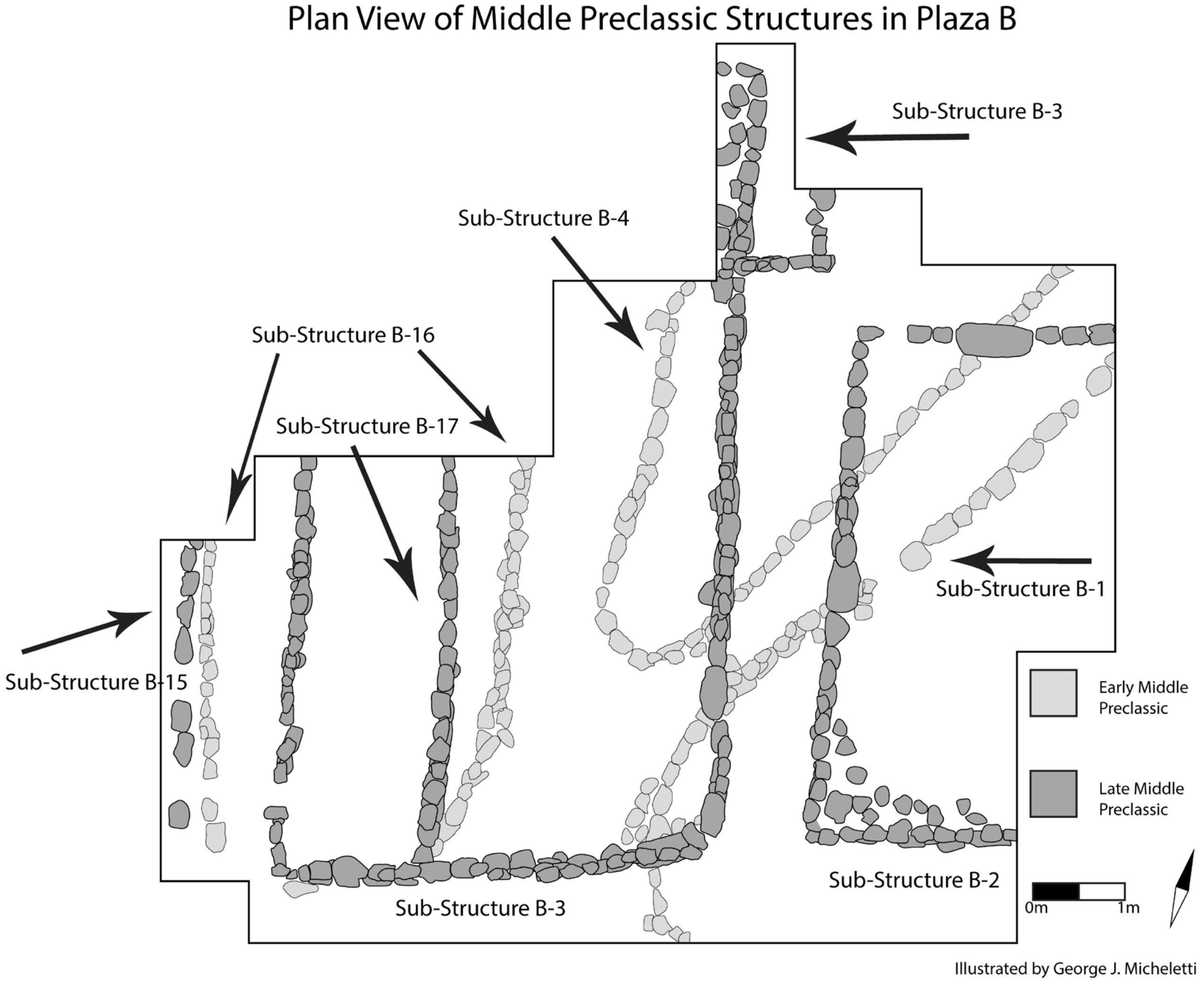

Figure 3.7. Isometric plan of the 2017 investigations in Plaza B showing Sub-Structures B-1, B-4, and B-16.

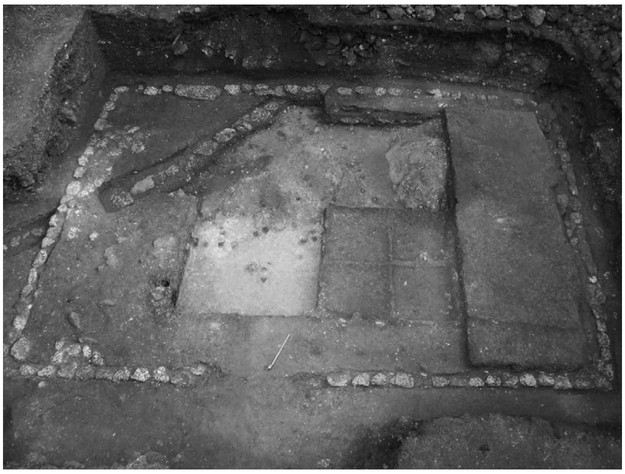

Figure 3.8. Horizontal exposure of Sub-Structure B-2.

in two of the platforms, Sub-Structures B2 and B3, and were made of tamped marl, measuring 3-5 cm thick. Tamped marl surfaces covered both the platforms and the alleyways. The late Mai phase platforms were larger and more elaborate than early Mai houses. Sub-Structure B2 was completely excavated in 2010 (Figure 3.8), and measured 9 m by 6 m, or 54 m^2 of living/working space (Powis *et al*. 2009). To date, this structure represents one of the largest late Middle Preclassic example of Maya domestic architecture unearthed in the Belize Valley. Sub-Structure B2 falls into the 'medium' (41-70 m^2) category of residential mounds for all periods of occupation at Pacbitun, and just above the average size (of basal dimensions) of 48.6 m^2 (Healy *et al*. 2007:28).

Associated with all of the late Mai platforms in Plaza B was the presence of shell ornament production. Investigations into the floors and alleyways revealed large quantities of shell ornaments in various stages of production, marine shell detritus, and chert microdrills (Figure 3.9). The Pacbitun shell assemblage (n=8,783) represents the largest Preclassic collection in the Belize Valley, consisting of 5,046 modified shell specimens and 2,690 pieces of marine shell detritus. The formal tool assemblage shows clear evidence of burin spall technology, including both burin spalls and microdrills (n=357). The recovery of so many of these artefacts, found in close association to one another, is indicative of a shell bead industry that lasted throughout the late Middle Preclassic.

Ceramics recovered from test pits into associated floors of these platforms contained mostly late varieties of Savana Orange and Jocote Orange-Brown pottery types (Figure 3.10). Their stratigraphic position (above Sub-Structures B1 and B4) also suggests a late Middle Preclassic date for these more substantial platforms. Finally, a radiocarbon date (Beta-93776), at cal BC 525-395, was obtained of charcoal from a stratum (Level 4) of Sub-Structure B3, again reinforcing the late Middle Preclassic temporal assignment (Healy 1999:70-71; Powis *et al*. 2009:172). With the exception of one intact Jocote Orange-Brown: Ambergris Variety pottery vessel found recessed in the centre of the floor of Sub-Structure B2 (Figure 3.11), the bulk of the excavated pottery is represented by sherd material. Overwhelmingly, the sherds were derived from two groups: Jocote (64%) and Savana (26%). Minor amounts of Joventud (2%), Chunhinta (1%), and Sayab (1%) were also identified.

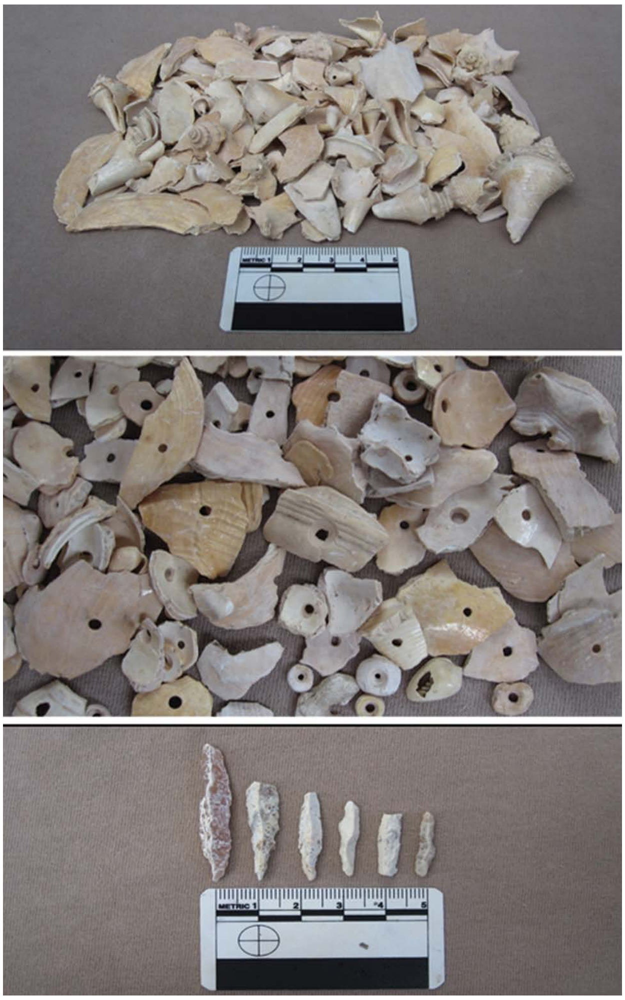

Figure 3.9. A representative sample of marine shell detritus (top row), marine shell beads (middle row), and chert microdrills (bottom row) from late Mai contexts in Plaza B.

Analysis of the sherd material from several of the house platforms in the plaza strongly indicates that the assemblage is very similar to Belize Valley sites. In fact, macroscopically, the late Mai material is virtually identical to late Jenney Creek pottery found at Barton Ramie, Blackman Eddy, and Cahal Pech, among others. In essence, the only significant difference between Pacbitun and sites located in the Belize Valley is the preponderance of the Savana and Jocote Groups; otherwise, the assemblages mirror each other.

Plaza A

North Side

For nearly three decades, from the mid-1980s-2010s, research in Plaza A had uncovered a limited amount of

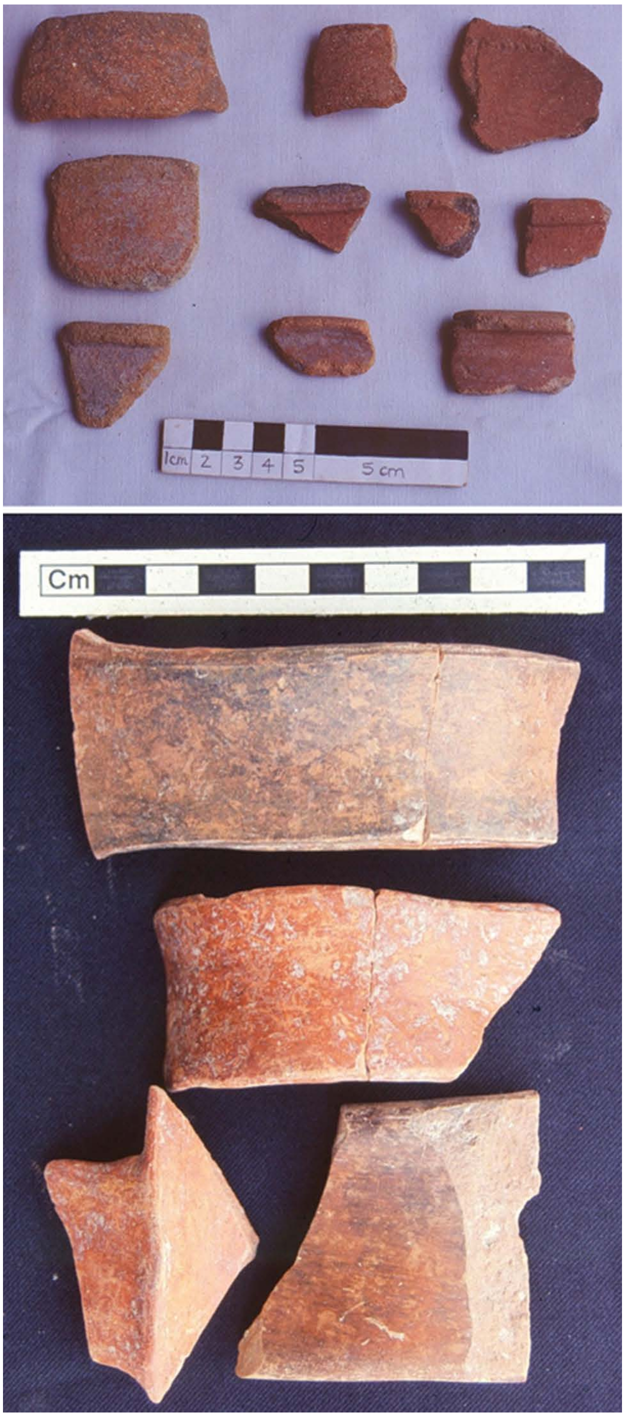

Figure 3.10. A representative sample of late varieties of Jocote Orange-Brown and Savana Orange pottery types from late Mai contexts in Plaza B at Pacbitun. Top row: Jocote Orange-brown rim sherds; Bottom row: Savana orange strap handles from chocolate pots.

evidence of Middle Preclassic occupation. In the 1980s, Healy (1990a) placed several units into Plaza A to determine not only the chronology for the plaza but also to identify any Preclassic occupation. In a test unit placed in front of Structure 2, he encountered portions of the initial plaza surface, at a depth of 3.5 m. This plaza floor was located within 20 cm of bedrock. Charcoal recovered below this floor dated to 770 BC+/- 170. Another unit was placed in front of Structure 4. He found the same plaza floor surface, dating to 800-775 BC. Additionally, he found the face of a single-course platform dating to the Middle Preclassic. Healy made no determination whether the platform was non-residential in function.

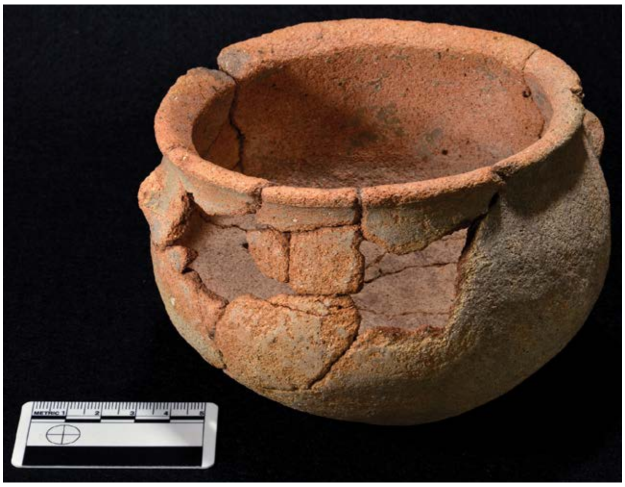

Figure 3.11. Photo of an intact Jocote Orange-brown: Ambergris Variety jar found embedded in the floor of Sub-Structure B-2.

Since 2011, PRAP has been building on Healy's earlier research— trying to learn as much as possible about the relationship of the Middle Preclassic community in Plazas A and B. In 2012, we encountered an anomaly below three successive plaza floors in Plaza A while conducting a geophysical survey (Skaggs and Powis 2014; Skaggs *et al*. 2016b). A unit set to investigate this anomaly in 2013 exposed the summit of a large ceremonial platform buried about 50 cm below the modern ground surface. Five successive years of large-scale investigations worked to expose a significant portion of the monumental building. This platform, although heavily burned, was buried largely intact. Given the extensive burned surface, we dubbed the platform 'El Quemado', which means 'The Burned One' in Spanish. El Quemado will hereafter be referred to as Q.

Located at the north end of Plaza A, Q is a large pyramidal platform measuring 32.5 m long (east-west) by 20.4 m wide (north-south) by 2 m high (Figure 3.12). Based on ceramics recovered from three excavation units penetrating to bedrock in the centre of Q, as well as multiple radiocarbon dates and its stratigraphic position in relation to successive plaza floorings, Q dates to the late Middle Preclassic period, ca. 600-400/300 BC. No earlier constructions were found under Q. Excavations on the summit revealed no evidence of a superstructure, supporting the building's public ceremonial function. Surrounding the platform is a thin 2-3 cm thick lime plastered plaza floor, the first to be laid down in Plaza A. The plaza floor sits directly on a scraped bedrock surface. Equally burned, the plaster surface encircles Q but does not continue underneath it, indicating that the platform was constructed first. Q is oriented in an east-west fashion, aligned 16 degrees west of north. The construction consists of two connected parts – a rectangular stone

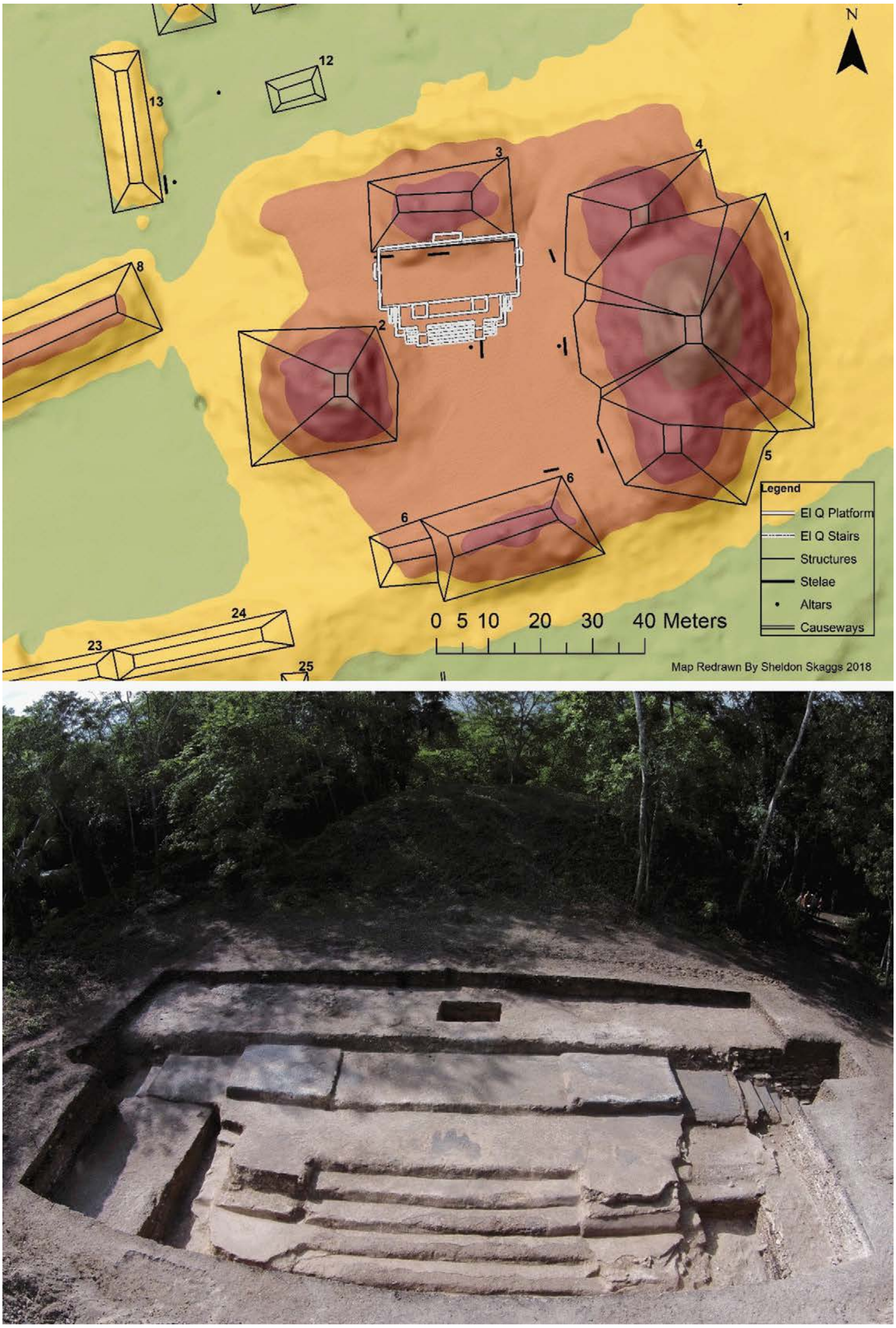

Figure 3.12. Top: Location of Q at the north end of Plaza A at Pacbitun. Bottom: Photograph of Q, looking north, with Structure 3 in the background. (Powis *et al.* 2019a: Figure 2, reproduced with permission).

foundation platform and a large staircase appended to this platform's southern end. Interestingly, no cut stones were used to construct Q's stairs. Rather, the entire staircase was moulded from a light brown coloured marl. Both the stone foundation and the stairs were completely covered in a thin 3-5 cm layer of lime plaster. The limestone blocks used in the construction of the stone foundation are larger (up to 1 m in length and 50 cm in width) than those used in the late Mai houses situated in Plaza B. The large central staircase, measuring 3 m wide, is composed of eight steps from the plaza floor to the summit of Q. A pair of undecorated upper and lower armatures separate the main staircase from two flanking supplementary stairways. All three stairs ascend to the same wide landing (five steps up from the plaza floor via the central staircase), which is directly appended to the south side of the building's main platform. Also fixed to the platform, two additional staircases descend the landing to the east and to the west. Centred between these stairs, a long shallow step flanked by two raised platforms is positioned just below the structure's summit. On the north, east, and west sides of Q, excavations also revealed the presence of appendages (Figure 3.13). The appendages were centrally located on each of the three sides and measured 2 m long by 1 m wide by 1 m high. These appendages may have been functional in that they served as a single step with which to ascend each of the different sides; however, it is equally plausible that they served a purely decorative function as well.

Fragments of sculptured plaster chopped from the platform's southern fascia were found on the appended east and west descending stairs indicating that masks had once adorned the corner facades of the building. In addition to the decimation of the masks, all terraces, armatures, corners, and the nose of each stair had been chopped in antiquity. Coupled with the extensive burning across the entire surface of Q, as indicated by the plaster's calcined state, the platform was partially razed at the end of the late Middle Preclassic (400-300 BC). Prior to the act, the surface of Q appeared to have been swept clean

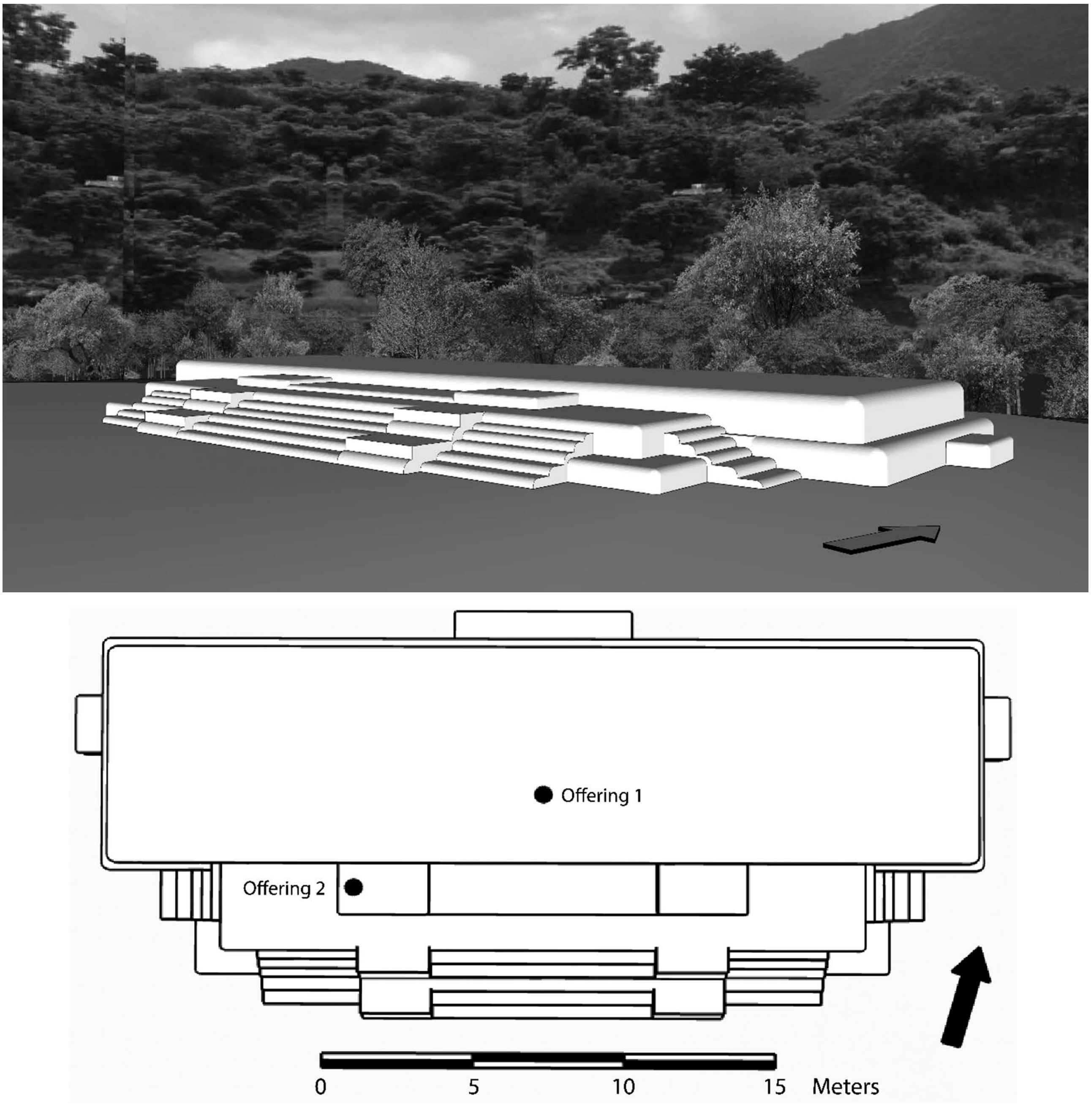

Figure 3.13. Top: Reconstruction of El Quemado in Sketchup, looking northwest. Bottom: Plan view of El Quemado in Sketchup (Powis *et al.* 2019a: Figure 3, reproduced with permission).

of artefactual material. Two ritual offerings (Offerings 1 and 2), each composed of a single ceramic vessel of the Savanna Orange: Rejolla Variety (Gifford 1976), were placed post-immolation on the building's summit (Figure 3.13). Rather than renewing the building with subsequent constructions, the inhabitants of Pacbitun decided to bury the building virtually intact-the interment and destructive rites suggesting the ritual termination of Q (Powis *et al*. 2019a). The platform was then covered in a 5 cm thick layer of clay aiding in its preservation.

Q is a rare example of exposed late Middle Preclassic ceremonial architecture. It is thought that all late Mamom sites likely had similar public ceremonial constructions, though the size and scale of these constructions may have differed between sites. Some of the early building phases of Structure B1 at the Belize Valley site of Blackman Eddy (Garber *et al*. 2004a:42-43) appear to share similar architectural features with Q. Of those phases, Structure B1-4th and B1-3rd most resemble the ceremonial platform at Pacbitun and were in use at roughly the same time. In addition to the architectural resemblances with Q, Structure B1-4th was also documented to have undergone similar methods of destruction. The summit of B1-4th had evidence of extensive burning, whereas the masks and upper surfacing of the walls had been torn from its edges (Brown and Garber 2003:98). Furthermore, comparisons can also be made to the Lost World Pyramid at Tikal and E-VII Sub at Uaxactun, as well as earlier Middle Preclassic buildings within both structures (Laporte and Fialko 1994, 1995:48; Ricketson and Ricketson 1937).

South Side

Investigations were placed at the south end of the plaza to identify any Middle Preclassic ceremonial architecture that may have been erected on the opposite side of the plaza from Q. We placed multiple contiguous units (Units 18-A-A2-18-A-A9), measuring 7 m x 4 m, at the base of Structure 6 on the plaza side. Once excavations reached a depth of 1 m, portions of three late Middle Preclassic platforms (designated as Sub-Structure A1-A3) linearly aligned east-west were encountered. Two of the platforms (Sub-Structures A1 and A3) were rectangular or square in shape with the third platform (Sub-Structure A2) being round (Figure 3.14). Sub-Structure A2 is centred between the other two platforms. Sub-Structure A1 and A3 are situated 1.7 m from Sub-Structure A2. All three platforms were built on top of the same plastered surface (3-5 cm thick) which may be the summit of a much larger flat-topped platform. This was determined by a small 1 m by 1 m unit that was dug to locate any earlier buildings below this surface. Penetrating the presumed summit, we immediately encountered a 1 m layer of black clay that contained only a few sherds, not observed anywhere else in Plaza A. Interestingly, this arrangement of three structures surmounting a large platform is reminiscent of the triadic complex so often observed at the end of the Middle Preclassic period. Structure B1 at Blackman Eddy provides a good example of this complex (Garber *et al*. 2004a). These triadic arrangements are typically situated on large flat-topped platforms, which seems very similar to what we have found in front of Structure 6.

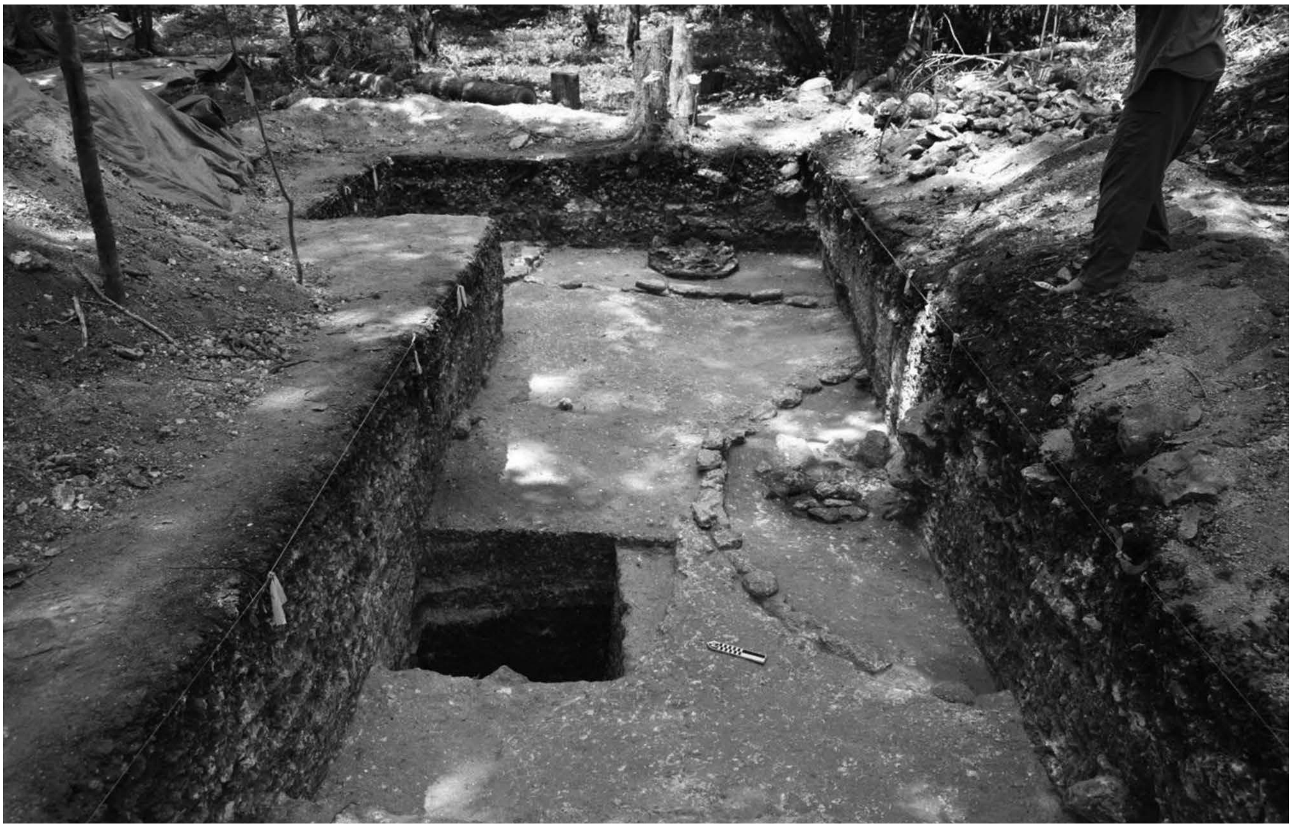

Figure 3.14. Photograph looking east toward Sub-Structure A-2 (Powis *et al.* 2019b: Figure 13).

The three platforms consist of a single course of roughly-hewn cut limestone blocks. The stones range in size from 8-18 cm wide to 22-40 cm in length. The exposed western wall of Sub-Structure A3 measures 4 m long while the exposed eastern wall of Sub-Structure A1 measures 2.5 m long. At present, it is difficult to say how wide each of these two platforms are based on our 2018 excavations. Of note, attached to the western wall of Sub-Structure A3 is another wall that may have served as a porch or an exterior activity area. For Sub-Structure A2, we can state that the width of this round or oval platform measured 4-4.5 m wide from east to west.

The most significant findings in the excavation unit placed in front of Structure 6 are the two fire pits located inside Sub-Structures A2 and A3 (Figure 3.15). Both are circular in shape and located adjacent to a platform wall. The fire pits are set into the plaster floor surfaces. All of the stones in each fire pit contain cut stones that are of the same size and shape as those used in the construction of the three platforms. The fire pit in Sub-Structure A3 measures 80 cm east-west by 74 cm north-south and the fire pit in Sub-Structure A2 measures 86 cm east-west by 84 cm north-south. These fire pits are unusual finds, not only at Pacbitun but across the Belize Valley. Not one intact fire pit has been excavated at any other Middle Preclassic site in the valley.

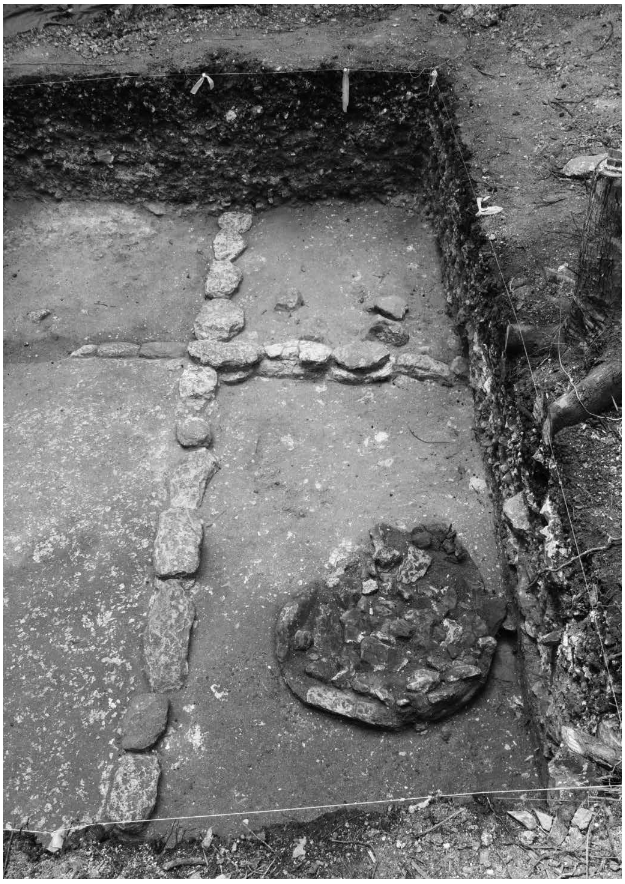

Figure 3.15. Photograph looking north at the fire pit inside Sub-Structure A-3 (Powis *et al.* 2019b: Figure 15). Note the circular shape and burned cut stones.

Traditionally, fire pits found in the eastern Maya lowlands appear to have served a domestic function related to cooking (Chase *et al*. 2018:163; Hammond and Gerhardt 1990:466-469, 476; Gerhardt 1988:90; Gerhardt and Hammond 1991:99-103). However, current research at sites like Caracol, Santa Rita Corozal, and Tikal seems to indicate that fire pits appear to be associated with ritual burning episodes. At these sites, burning has also been intimately associated with the interment of individuals (Chase *et al*. 2018:165). Continued research in front of Structure 6 may yet locate burials that may be connected to the fire pits and therefore determine whether the association of purposeful fire with ritual activity and death was a practise originating in the Middle Preclassic period.

As mentioned above, the three platforms date to the late Middle Preclassic period. This is based on ceramic material only as radiocarbon dating has yet to be conducted. Ceramically, sherds almost exclusively belonging to the Jocote and Savana Groups have been identified from inside each building. While no sherds were recovered from either fire pit, they are both stratigraphically positioned inside of the basal foundations indicating contemporaneity. The three platforms, like Q, were only in use for a couple hundred years before being abandoned.

Major Transformations in Plazas A and B

Around 400/300 BC, we see the termination of Q and the abandonment of the three platforms in front of Structure 6 in Plaza A. Major renovation occurs at this time. Four north-south oriented task units set at 8 m intervals, running the length of Plaza A, were constructed to build up and enlarge the plaza (Micheletti *et al*. 2016, 2017, 2018; Powis *et al*. 2017). All four task units terminated into the summit of Q, and at these termination points we see a number of cut stones robbed from the foundation to be used in the construction of the task units. Ultimately, once the task units were laid down, Q and Sub-Structures A1-A3 were covered with a thick early Late Preclassic plaza floor. This 15-cm thick plaza floor ran directly over the summit of Q and the fire pits inside Sub-Structures A2 and A3. It is this plaza floor that would support the E Group variant during the subsequent Classic period apogee at Pacbitun (see chapter five, this volume).

At the same time in Plaza B, the deposition of a 1 m thick midden was laid down over the top of the late Mai platforms as well as the round platform in Court 2. The deposit consisted of dark, organic soil densely packed with domestic refuse that included ceramics, lithics, animal and plant remains, as well as shell ornaments in various stages of production, marine shell macro-detritus, and chert microdrills. Additionally, tens of thousands, perhaps hundreds of thousands, of *jute* (edible freshwater snails) were also found in this midden. Ceramics from inside the midden were diverse in types and forms and included both utilitarian and non-utilitarian wares. The majority of the ceramic material recovered from the midden consisted of sherds, although partial vessels of Savana Orange:

Savanna Variety and Reforma Incised: Reforma Variety were also found. A total of 3,324 sherds were recovered from this deposit. In one test unit measuring 1 m by 1 m, we recovered large rim sherds of Jocote Orange-Brown (n=95), Savana Orange (n=80), Reforma Incised (n=33), Sayab-Daub Striated (n=16), Joventud Red (n=9), Chunhinta Black (n=5), Chacchinic Red-on-orange-brown (n=1), Sierra Red (n=3), and Flor Cream (n=2). The majority of the ceramic material is diagnostic of the late Middle Preclassic. The presence of small quantities of Sierra Red and Flor Cream Group ceramics indicate that the midden may have been deposited closer to the end of the late Middle Preclassic (400-300 BC). One charcoal sample (Beta-93773) has a pair of calibrated date ranges cal BC 760-670 and cal BC 550-405, with the second (younger) range falling near the end of the late Middle Preclassic period (Healy 1999:70-71).

The presence of the secondary midden over top of the Middle Preclassic residential community signifies a major change in the use of space in this part of the site. This late Mai phase community of houses and associated shell workshops, which brought sustained wealth to Pacbitun for 600 years, was replaced with the first lime-plastered plaza floor in Plaza B, signalling a shift from private to public space.

By the close of the Middle Preclassic, about 400/300 BC, Pacbitun underwent a significant, large-scale alteration, renewal, and population growth. All of the constructions in Plazas A and B were intentionally buried. Plaza B was raised substantially, about a metre, thus creating a large public area. In the six centuries of the Late Preclassic Puc phase (300-100 BC) and Terminal Preclassic Ku phase (100 BC-AD 300), we see evidence for marked social differentiation, impressive civic planning, and large-scale monumental architecture at Pacbitun. In Plaza A, for example, a large flat area was established (some 6 m above Plaza B), and construction of a variant E Group Complex was begun, with Structure 2 raised on the west and Structure 1 on the east. The latter had wing-like stepped platforms positioned adjacent to it (Structure 4, north, and Structure 5, south), ultimately forming a triple-pyramid complex on the east side of Plaza A. While the eastern buildings of the E Group began as three separate edifices, Structure 1 eventually becomes the largest (12 m tall) at Pacbitun, and (in the process) engulfs adjacent Structures 4 and 5 in the Terminal Preclassic. All would be enlarged during the Classic period and were associated with multiple elite burials at the site, and the erection of several stelae (Healy *et al*. 2004). Across Plaza A, Structure 2 ultimately reached 11 m tall, and contained additional elite burials and caches of its own.

In Plaza B, during the Late and Terminal Preclassic, atop the newly laid Plaza B floor 1, there is evidence (from excavations of Structure 23) for construction of the first elite residential and administrative constructions at Pacbitun. These would also grow in size, number, and elaboration through the Terminal Preclassic and Classic periods, into a sprawling royal residential compound, composed of perhaps as many as 13 elevated, long, range structures with interior benches, private courtyards, and attached craft workshops (Healy *et al*. 1995; Lawrence and Pierce 2018; Skaggs and Cherico 2018).

Periphery

The Middle Preclassic period at Pacbitun is restricted to the site core. There is considerable architectural and artefactual evidence for occupation in the two main plazas dating to both the early and late facets of the Mai phase. In the periphery, there are 330 mounds that have been surveyed within a 1 km^2 radius of the site core. Fifty of these mounds have been tested (Balinger *et al*. 2015; Campbell-Trithart 1990; Cartagena 2018; Healy 2014:16; Healy *et al*. 2004a:217-218; Healy *et al*. 2007:23; Powis *et al*. 2017:194; Richie 1990; Skaggs *et al*. 2016a; Sunahara 1995; Ward 2013), producing only traces of Mai pottery. Of the 12,648 sherds recovered from the 50 tested mounds, only 19 sherds (or 0.15%) date to the Middle Preclassic period. These sherds belong to four ceramic groups: Jocote (n=9), Joventud (n=5), Savana (n=4), and Pital (n=1). At present, it appears that the earliest occupation remains confined to the site core.

Discussion

The earliest occupation at Pacbitun begins a few centuries after the Belize Valley is initially settled at such sites as Blackman Eddy, Cahal Pech, and Xunantunich. Pacbitun is the only site immediately south of the Belize Valley that is occupied during pre-Mamom times. Both Caracol and Tipan, the two closest and largest Classic period sites, have not yielded any pre-Mamom deposits (Arlen Chase and Gabriel Wrobel, personal communication, 2019). This indicates that, to date, Pacbitun was an isolated community when it was first settled around 900 BC.

Pacbitun begins as a small agricultural village of about 25-50 people who were most likely a related kin-based group (Healy 1990a; Powis *et al*. 2017). These early Maya were sedentary, like those settlements in the Belize Valley, living in a community situated on a plateau/hilltop overlooking the fertile bottomlands. In early Mai times we have solid evidence of architectural remains, both domestic and non-domestic, and artefacts recovered from excavations in Plaza B at Pacbitun. These early Maya built apsidal-shaped houses that were planned, organised, and formed a grid pattern with equally-spaced alleyways separating each domicile. They practised a mixed subsistence involving maize agriculture and the exploitation of local plants, animals, fish and shellfish (see chapter four, this volume). They were engaged in such economic pursuits as marine shell bead production, which likely involved the ornaments being exchanged with other sites elsewhere in the region, including those in the Peten. The ability to import hundreds, if not thousands, of whole marine shells attests to the ability of the Maya at Pacbitun to maintain and sustain a level of exchange throughout the early Mai phase. The shell industry brought numerous changes to this early community due to its new wealth. We see a diverse assemblage of nonlocal artefacts enter the site at this time, of which marine shell is but one class. The presence of obsidian and greenstone in each of the early Mai houses is important to note because it shows early, long-distance and complex trade networks in nonlocal raw materials with obsidian coming from the Guatemalan highlands (Healy and Awe 1995) and greenstone derived from Central Mexico (Powis *et al*. 2016). Perhaps one of the biggest changes involved the construction of a large round platform erected at the south end of the residential community. The round platform represents the first ceremonial construction at Pacbitun. And, as such, the performances that took place on top of it were viewed by the members of the community from equal vantage points around the platform.

Around 600 BC, major changes continue at Pacbitun. The site is no longer an isolated community at this time. There is a population expansion and a corresponding increase in the number of new sites as well as new construction at existing sites found in and around the Belize Valley. At this time, Caracol is first settled. The evidence is scant from Caracol, but a single Middle Preclassic burial was found in the mid-1990s in the western building of the Veracruz Group which is located 4.5 kms from the epicentre (Chase and Chase 2006a:41). At Pacbitun, population increases in late Mamom times (as evidenced by new houses being built) and with it come significant changes to the early Mai community. Surprisingly, the population increase remains restricted to the site core. Based on current settlement information, there is no evidence of any late Mamom architecture built in the periphery, a pattern that is not followed elsewhere in the Belize Valley. For example, at Cahal Pech, Awe (1992) and others (Iannone 1996; Lee 1996; Lee and Awe 1995; Powis 1996) have reported that by late Mamom times some families left the site core to settle adjacent hilltops (e.g., Cas Pek, Tolok and Zubin Groups) up to 2 kms away. This infilling around the site centre is not observed at Pacbitun. Instead, families decide to remain nucleated and more densely packed than that observed elsewhere in the valley.

In Plaza B, new construction of domestic architecture significantly expands the size of the community. Houses continue to be built in the same exact location as their predecessors, with the familiar grid pattern remaining firmly in place. The orientation of the houses shifts north-south, with alleyways located between houses persisting in the new layout. In the midst of a residential reconfiguration in Plaza B, the residents of Pacbitun constructed their second public building, Q, to the east in the adjacent Plaza A—a natural rise in the landscape set 5 m above the houses in Plaza B. Q is built on the highest elevation at the site (where all subsequent ceremonial architecture is built). Prior to this, the area designated as Plaza A had remained vacant in early Mai times. The size and scale of Q dwarfs the ceremonial round platform built (and abandoned) in early Mai times in Court 2. In fact, Q, as the sole successor of Sub-Structure C2, is three times larger, underscoring the labour involved in such a massive building project. Q's size, architectural design, and elevated location are indicative of its ceremonial function. Although all of these traits separate Q from its predecessor located in Court 2, it is really the architectural design of Q that separates it apart the most from a ceremonial perspective. Sub-Structure C2 provided equal access for viewing by members of the early Mai community because of its round form. Q also afforded the same access in terms of the public being able to view performances on top of it but the major change in late Mai times was that Q had the addition of stairs. The presence of stairs forced members of the community to stand on one side of the platform (the south side) and look north toward the performances taking place on the summit. In the same vein, the performers standing on the stairs and/or summit of Q needed to face south in full view of the public attending the ceremony. This would have been different for ceremonies taking place on top of Sub-Structure C2 as performances could face any direction to be in full view of members of the early Mai community.

Further east of Plaza A, the area of the site core known as the Eastern Court, is artificially raised about 5 m above bedrock (Cheong 2013). By late Mai times, Pacbitun has a recognisable east-west orientation, running from Plaza B to the Eastern Court some 200 m wide. This lateral expansion is significant in that Q, the largest public construction effort at the site, is centrally located between Plaza B and the Eastern Court. However, Q may be more than the physical centre of this late Mai community at Pacbitun. We could be witnessing what Joyce (2004:23) observed at Los Naranjos in Honduras:

> As visually omnipresent and stable points of reference in their communities, the monumental platforms also created physical centers in these Formative villages, an effect which their later descendants most notably carried on in their practices of locating temple platforms in central locations in communities. But again, rather than assuming that Formative precursors were built to center the community on an already valued axis mundi, I suggest we consider that, once these focal points existed, they lent themselves to the elaboration of new spatial stratifications of communities in terms of periphery and center.

As in early Mai times, the economy continues to be driven by marine shell bead production for another 200/300 years. Marine shells were imported whole from the Caribbean Sea, over 100 kms away, and were manufactured into disc beads possibly destined for markets in the Peten of Guatemala. During this timeframe, the houses in Plaza B increased in size, height, and quality of construction. These were golden times for Pacbitun. But, this late Mai community lifestyle was replaced wholesale, with drastic changes to domestic architecture (elite houses now being built in Courts 1-3 and domestic houses built in the periphery), ceremonial architecture (Q is terminated for the construction of the E Group in Plaza A), and the economy built on marine shell production is replaced with the production of manos and metates made from locally sourced granite (see chapter fourteen, this volume). Clearly, by the start of the Late Preclassic period (400-300 BC), with large-scale site modifications and the introduction of a new formal plan with far-flung origins and widespread influence, the ceremonial centre of Pacbitun was put into place, including the initiation of the large-scale masonry architecture, presaging the site's Classic period (AD 250-900) florescence.

Conclusions

Over the past four decades, archaeological research has revealed substantial Middle Preclassic deposits at Pacbitun. Evidence from the site is significant in that we see the Maya were already inhabiting the more marginal farmlands near Pacbitun at such an early date. It strongly suggests that the more fertile riverine valley lands to the west and north were already settled by the onset of the Middle Preclassic (ca. 900 BC), earlier than previously realised. Pacbitun appears to represent a site whose population successfully adapted to, and exploited, not only the traditional lowland rainforest environment but also the strikingly different Mountain Pine Ridge ecozone. The inhabitants flourished over the next 1800 years. Through our investigations, we have been able to trace the founding settlement located in Plaza B as well as document both the construction of domestic and non-domestic architecture throughout the site core. The acceleration of architectural activity coincided with an increase in the population of the site around 600 BC. This population increase is undoubtedly the result of the shell industry that was driving the local economy at the time. Thousands of shells from one platform alone is indicative of the volume of finished beads that were most likely being traded/exchanged across the region and perhaps beyond the Belize Valley. The archaeological analysis of these early residential and ceremonial platforms excavated at Pacbitun has produced important, and needed, data on Middle Preclassic Maya household and community organisation, social structure, religion, subsistence, and craft specialisation.

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4

Middle Preclassic Faunal Utilisation at Pacbitun, Belize: Evidence for Ritual Practice, Exchange, and Craft Specialisation

Arianne Boileau and Norbert Stanchly

The Middle Preclassic has long been considered a time during which small farming communities populated the landscape. However, recent archaeological investigations suggest that the Middle Preclassic (900-300 BC) saw the rise of social and ritual complexity in the southern Maya lowlands (Estrada-Belli 2011; Healy *et al*. 2004c; Inomata *et al*. 2013). One way in which the Maya expressed this increasing complexity was the management of animals, such as dogs (*Canis lupus familiaris*, Sharpe *et al*. 2018; White *et al*. 2001) and turkeys (*Meleagris gallopavo*, Thornton *et al*. 2016). These traded and/or husbanded animals were sometimes included in ceremonial events that may have allowed individuals to acquire and maintain political power. Relations between individuals and groups of different socio-political statuses also involved objects made from bone and shell. During the Middle Preclassic, shell beads appear to have been traded as commodities and used as symbols of power and status (Castillo Velasco and Páez Torres 2015; Hohmann 2002; Isaza Aizpurúa and McAnany 1999).

Large-scale excavations at Pacbitun, Belize (see Figure 1.1), have uncovered several Middle Preclassic structures of both domestic and ceremonial nature. These offer an opportunity to examine whether animal use reflects the increasing socio-political complexity and ritualised behaviour identified by architectural and artefactual assemblages at the site. In this chapter, we consider the abundance and distribution of faunal remains, taxa, skeletal elements, and crafting products to document community organisation, ritual practice, craft specialisation, and participation in trade networks during the Middle Preclassic. We attempt to define how, by whom, and where animals were acquired, prepared, and consumed to evaluate social and economic relationships within the Pacbitun community.

Previous Zooarchaeological Work at Pacbitun

Pacbitun is situated at the juncture of two ecozones: the tropical rainforest and the Mountain Pine Ridge, with close access to the Belize and Macal Rivers and smaller tributaries. This position likely allowed the Pacbitun Maya to take advantage of locally contrasted environments and to forage a wide range of animal resources (see chapter two, this volume; Healy 1990a). Prior zooarchaeological work at the site supports this claim. Faunal remains dating from the Middle Preclassic to Terminal Classic periods have previously been recovered at Pacbitun by the Trent University Pacbitun Archaeological Project in the 1980s and by the Belize Valley Preclassic Maya Project in the 1990s. This material has been analysed by several scholars and published in an edited volume by Paul Healy and Kitty Emery (2014). We present here a summary of their results and interpretation (see also Table 2.1 for a list of previously identified taxa).

A total of 12,170 specimens were recovered by the two excavation programmes, the majority of which come from monumental structures and plazas. The remains represent a diverse taxonomic set (54 taxa) (Emery and Healy 2014). A chronological assessment of faunal patterns suggests both stability and change in animal resource use. Mammals were very diverse but dominated by artiodactyls (white-tailed deer [*Odocoileus virginianus*], peccary [Tayassuidae], and brocket deer [*Mazama* sp.]). Other important animals include mud/musk turtles (Kinosternidae), agouti (*Dasyprocta punctata*), paca (*Cuniculus paca*), and armadillo (*Dasypus novemcinctus*). The abundance of these favoured animal resources remained stable over time. The Maya most likely used them as food sources alongside agricultural products. Interestingly, dog, a ubiquitous species at most Maya sites (Emery 2004), is rare or absent at Pacbitun.

During the Middle Preclassic, vertebrate exploitation focused on a range of terrestrial resources (mainly large mammals), with the occasional turtle, fish, and bird (Stanchly 2014). The Pacbitun Maya were then engaged in the production of shell ornaments made from both freshwater and marine shells, but particularly conch (Strombidae) (Hohmann 2014; Hohmann *et al*. 2018). This is attested by the recovery of thousands of shell beads, both broken and complete, thousands of pieces of shell detritus, and hundreds of chert drills used to perforate the shell (see Figures 3.4, 3.9). Freshwater shells were also very abundant and may have held dietary importance (Emery and Healy 2014). A shift is observed during the Late Preclassic; the production of marine shell beads was no longer a large-scale activity, and resource exploitation focused instead on freshwater shells and artiodactyls (Stanchly 2014; Wagner and Healy 2014). In fact, from the Late Preclassic to Terminal Classic, most of the marine shell specimens are represented by non-utilitarian artefacts whose access was restricted to elite individuals (Wagner and Healy 2014). The absence of evidence for shell craft specialisation during these later periods suggests that bone and shell artefacts (e.g., bone hairpins, needles, and tubes, as well as shell rosettes, ear flares, mosaics, and more) were acquired in finished or near finished form through exchange networks.

Freshwater shells and artiodactyls continued to be abundantly used during the Early Classic (Emery and Baker 2014; Wagner and Healy 2014). This period also sees an increase in the quantity and diversity of exotic artefacts, many being deposited in elite burials (Healy *et al*. 2014). These include thorny oyster (*Spondylus americanus*) and stingray spines (Rajiformes). During the Late Classic, freshwater shells diminished in importance, while marine shells became more abundant and diverse (Wagner and Healy 2014). Mammals, less common than before, appeared to have been used for ritual rather than dietary purposes (Emery and Baker 2014); most Late Classic faunal remains were found in ceremonial deposits. During the Terminal Classic, deer and peccary remained important resources (Emery and Baker 2014). Marine shells were less abundant but continued to be the most common faunal resource, with a few specimens attesting to connections to Pacific Coast trading networks: Pacific thorny oyster (*Spondylus crassisquama*), pustulated cowrie (*Jenneria pustulata*), and Pacific tent olive (*Oliva porphyria*) (Healy *et al*. 2014).

The Pacbitun fauna suggests that the site's residents predominantly exploited animals from local habitats. Non-local animals, mainly marine taxa, were rare, except for the large quantities of marine shells brought to Pacbitun for shell bead production during the Middle Preclassic. The Pacbitun Maya favoured the exploitation of animals visiting open habitats, such as the Mountain Pine Ridge, agricultural fields, and secondary forests, while mature forest taxa were exploited to a lesser extent (Emery and Healy 2014).

Archaeological Contexts

Faunal remains considered in this analysis were recovered from structures dating to the Middle Preclassic (Mai phase, 900-300 BC) in Plazas A and B at Pacbitun. Multiple Mai structures were identified under the Late Preclassic (Puc phase, 300-100 BC) floor of Plaza B during three excavation phases: 1995-1997, 2008-2010, and 2017. The oldest platforms (Sub-Structures B1, B4 and B16) date to the early Mai phase (900-600 BC) and are interpreted as domestic households engaged in shell ornament production (see Figure 3.7). New platforms (Sub-Structures B2, B3, B5, B11, and B13) were constructed atop the preceding ones during the late Mai phase (600-300 BC; see Figures 3.7, 3.8). These also served as domestic households and shell bead workshops (Powis *et al*. 2017). Sometime during the late Mai phase, the structures were abandoned and covered with a thick midden-like deposit. More detailed descriptions of these contexts can be found in chapter three, this volume.

The 2013-2018 excavations in Plaza A also uncovered a massive platform, dubbed 'El Quemado' or 'Q' (the 'burned one') (see Figures 3.12, 3.13). Q was constructed in one phase during the late Mai phase (ca. 600-400/300 BC). It was most likely used for public rituals until about 400-300 BC when the structure was burned and buried under a plaza floor (see chapter three, this volume; Powis *et al*. 2017).

Methodology

Field Methods and Sample Recovery

Excavations in Plazas A and B were conducted with trowel and shovel following natural stratigraphy (as opposed to arbitrary levels). Faunal remains were collected with 1/4-inch sieving, although remains from the floor deposits of Sub-Structures B1 and B2 were also wet-screened using 1/16-inch mesh screen. The remains were recovered from both primary (floor and perimeter deposits) and secondary (construction fill, structural fill, and secondary middens) contexts. During the 2008-2010 and 2017 excavations in Plaza B, special attention was given to the recovery of artefacts from floor deposits; any artefacts found 5 cm below a floor's surface was considered as secondary fill rather than primary floor deposits.

Methods of Zooarchaeological Analysis

Stanchly identified all vertebrate and invertebrate remains from Plaza A as well as the 2017 vertebrate and invertebrate assemblage from Plaza B (Stanchly 2016a, 2017, 2018). Boileau identified all other Plaza B vertebrate remains as part of her master's thesis (Boileau 2014). Part of her sample included specimens previously identified by Stanchly (2014) that she re-analysed to take advantage of access to comparative collections larger than those initially available to Stanchly and to allow for a detailed taphonomic analysis of the remains. All remains were identified using comparative collections from the Department of Vertebrate Palaeontology at the Royal Ontario Museum (Toronto, Canada) and osteology manuals (e.g., Barone 1986; Olsen 1982). Boileau also consulted comparative specimens from the Trent University Archaeozoology Laboratory (Peterborough, Canada). The 2017 faunal remains were identified in Belize using comparative collections in possession of Stanchly.

All remains were identified to the highest taxonomic order. When possible, indeterminate mammals were attributed to a body size class: large mammal (>15 kg, e.g., deer, peccary, jaguar), large-medium mammal (7-15 kg, e.g., monkey, dog, ocelot), medium mammal (2.1-6.9 kg, e.g., paca, armadillo, coati, fox), small-medium mammal (1-2 kg, e.g., rabbit, opossum), and small mammal (<1.0 kg, bats, rats) following Emery and Brown (2012). Most recent accepted nomenclature was verified with the Integrated Taxonomic Information System (http://www.itis.gov) and the World Register of Marine Species (http://www.marinespecies.org).

Standard zooarchaeological procedures were used to analyse the faunal assemblage (Lyman 2008; Reitz and Wing 2008). Data collected for each specimen include taxon, skeletal element, element side, portion, pathologies, and age and sex characteristics. Cultural and natural modifications were also recorded: surface preservation, burning, animal gnawing, butchery marks, and other artefact modifications.

Specimens were quantified using the Number of Identified Specimens (NISP) (Lyman 2008). In this study, NISP was calculated as any specimen identified to class level or below. NISP is a direct tally of all identified specimens and, as such, is simple and easy to replicate. However, it tends to over-represent taxa such as turtles and armadillos that have a large number of bones or those with more fragile bones (e.g., juvenile individuals) (Grayson 1984; Lyman 2008). It also does not account for the problem of interdependence, that is, the fact that multiple specimens identified to a taxon may be from a single individual (Grayson 1984; Lyman 2008). This problem was mitigated by refitting (i.e., conjoining two or more faunal specimens that belong to the same skeletal element or individual). MNI counts were not used in this study because of the small sample size, particularly for the vertebrate remains. A moderate to strong significant correlation between NISP and MNI values for the Plaza B vertebrate assemblages (early Mai phase $r_s = 0.58$, $p = 0.010$; late Mai phase $r_s = 0.56$, $p = 0.011$) suggests that the ranking of identified species provided by these two quantification methods is similar. Therefore, the use of both methods would be redundant.

Sample Description

The Pacbitun faunal assemblage contains 12,250 specimens, divided into 3,939 vertebrate and 8,311 invertebrate remains recovered from Middle Preclassic contexts within Plaza A and B (Table 4.1). The majority comes from Plaza B excavations (86.7 percent). Overall preservation of the remains ranges from poor to good. This is reflected in the high fragmentation rate of the assemblage and low identification rate of the vertebrate sample (only 28.6 percent identified below class level). Several natural and human taphonomic agents can contribute to this situation common among Maya faunal assemblages. The humid and wet environment of the tropics is not conducive to organic preservation (Stanchly 2004). Several human practices can also result in the fragmentation of faunal remains: artefact manufacture (Emery 2008), meat processing and marrow extraction (Merritt and Davis 2017; Todd and Rapson 1988), and refuse disposal practices (Cárdenas Cervantes and Götz 2015).

Taxonomic abundances from Plazas A and B are presented separately because they represent two different contexts (ceremonial and domestic) and date to different phases of the Middle Preclassic.

Plaza B

The faunal assemblage from Plaza B includes vertebrate and invertebrate material from the early and late Mai phases, for a total of 10,619 specimens. The material is distributed unevenly between time periods, with 1,911 and 8,708 remains in the early and late Mai assemblages, respectively.

The vertebrate assemblages from Plaza B include a total of 2,710 specimens, with 651 specimens dating to the early Mai phase and 2,059 from the late Mai phase (Table 4.1). Most of these specimens were identified to class level or below, for a total NISP of 2,376 (Table 4.2). The preservation of the remains ranges from poor to moderate. Extensive exfoliation and root etching are the two most common surface modifications. As a result, only 493 specimens (18.2 percent of the vertebrate assemblage) were identified to family or lower taxonomic level, with the bulk of the assemblage represented by unidentified mammal fragments ($n = 1,843$, 77.6 percent). Thirty-six taxa were identified spread across five classes (Actinopterygii, Amphibia, Reptilia, Aves, and Mammalia). Mammals are the most commonly identified animals (26.6 percent). Reptiles (0.5 percent), fish (0.1 percent), birds (<0.1 percent), and amphibians (<0.1 percent) form a fraction of the vertebrate assemblage.

Mammals are represented by 16 species and five families. The most frequently identified animals are artiodactyls: white-tailed deer, brocket deer, and peccaries. Most

Table 4.1. Chronological and contextual distribution of Middle Preclassic fauna at Pacbitun.

Taxon	Plaza B		Plaza B		Plaza A		Total
	early Mai phase		late Mai phase		late Mai phase		
	n	%	*n*	%	*n*	%	*n*
Identified vertebrates	513	26.8	1,863	21.4	1,206	73.9	2,376
Unidentified vertebrates	138	7.2	196	2.3	23	1.4	334
Total of vertebrates	651	34.1	2,059	23.6	1,229	75.4	3,939
Identified invertebrates	700	36.6	5,638	64.7	400	24.5	6,338
Unidentified invertebrates	560	29.3	1,011	11.6	2	0.1	1,571
Total of invertebrates	1,260	65.9	6,649	76.4	402	24.6	8,311
Grand total	1,911	100.0	8,708	100.0	1,631	100.0	12,250

Table 4.2. Identified Middle Preclassic fauna from Plazas A and B at Pacbitun by NISP counts.

Scientific Name	Common Name	Plaza B		Plaza B		Plaza A		Total	
		early Mai		late Mai		late Mai			
		NISP	%	NISP	%	NISP	%	NISP	%
Ictaluridae	Catfishes	1	0.1	--	--	--	--	1	<0.1
Serranidae	Groupers	1	0.1	--	--	--	--	1	<0.1
Sparisoma sp.	Parrotfish	--	--	1	<0.1	--	--	1	<0.1
Petenia splendida	Bay snook	--	--	--	--	1	0.1	1	<0.1
Actinopterygii	Fish	4	0.3	2	<0.1	6	0.4	12	0.1
Rhinella marina	Cane toad	--	--	1	<0.1	--	--	1	<0.1
Iguanidae	Iguana	2	0.2	3	<0.1	--	--	5	<0.1
Testudines	Turtles	11	0.9	13	0.2	12	0.7	36	0.3
Kinosternon sp.	Mud turtle	--	--	1	<0.1	--	--	1	<0.1
Colubridae	Colubrids	1	0.1	5	0.1	--	--	6	0.1
Crotalinae	Vipers	--	--	3	<0.1	--	--	3	<0.1
Reptilia	Reptiles	--	--	1	<0.1	2	0.1	3	<0.1
Galliformes	Turkeys, curassows	--	--	1	<0.1	--	--	1	<0.1
Aves	Birds	2	0.2	2	<0.1	17	1.1	21	0.2
Didelphis marsupialis	Common opossum	--	--	1	<0.1	--	--	1	<0.1
Didelphis virginiana	Virginia opossum	2	0.2	1	<0.1	--	--	3	<0.1
Didelphinae	Opossums	--	--	--	--	1	0.1	1	<0.1
Dasypus novemcinctus	Nine-banded armadillo	17	1.4	233	3.1	4	0.2	254	2.5
Canis lupus familiaris	Domestic dog	--	--	2	<0.1	--	--	2	<0.1
Canidae	Dogs, foxes	1	0.1	--	--	--	--	1	<0.1
Mustela frenata	Long-tailed weasel	--	--	1	<0.1	--	--	1	<0.1
Panthera onca	Jaguar	1	0.1	--	--	--	--	1	<0.1
Leopardus pardalis	Ocelot	1	0.1	--	--	--	--	1	<0.1
Leopardus wiedii	Margay	--	--	1	<0.1	--	--	1	<0.1
Puma concolor	Cougar	--	--	1	<0.1	--	--	1	<0.1
Felidae	Cats	1	0.1	1	<0.1	1	0.1	3	<0.1
Carnivora	Carnivores	--	--	--	--	1	0.1	1	<0.1
Tapirella bairdii	Tapir	--	--	1	<0.1	--	--	1	<0.1
Tayassuidae	Peccaries	6	0.5	8	0.1	1	0.1	15	0.1
Odocoileus virginianus	White-tailed deer	46	3.8	100	1.3	80	5.0	226	2.2
Mazama sp.	Brocket deer	7	0.6	11	0.1	2	0.1	20	0.2
Cervidae	Deer	1	0.1	10	0.1	19	1.2	30	0.3
Artiodactyla	Even-toed ungulates	2	0.2	--	--	--	--	2	<0.1
Orthogeomys sp.	Pocket gopher	4	0.3	2	<0.1	--	--	6	0.1
Cuniculus paca	Lowland paca, gibnut	3	0.2	--	--	3	0.2	6	0.1
Dasyprocta punctata	Central American agouti	2	0.2	1	<0.1	--	--	3	<0.1
Dasyproctidae/Cuniculidae	Agoutis/pacas	1	0.1	2	<0.1	2	0.1	5	<0.1
Rodentia	Rodents	--	--	3	<0.1	8	0.5	11	0.1
Sylvilagus sp.	Rabbit	2	0.2	2	<0.1	1	0.1	5	<0.1
Mammalia (small)	Small mammals	7	0.6	9	0.1	7	0.4	23	0.2
Mammalia (small-medium)	Small-medium mammals	5	0.4	13	0.2	41	2.6	59	0.6
Mammalia (medium)	Medium mammals	5	0.4	11	0.1	10	0.6	26	0.3
Mammalia (medium-large)	Medium-large mammals	45	3.7	496	6.6	366	22.8	907	8.8
Mammalia (large)	Large mammals	26	2.1	47	0.6	90	5.6	163	1.6

Mammalia	Mammals	306	25.2	873	11.6	531	33.1	1,710	16.6
Total of identified vertebrates		513	42.3	1,863	24.8	1,206	75.1	3,582	34.7
Arca sp.	Ark clam	--	--	1	<0.1	--	--	1	<0.1
Spondylus sp.	Thorny oyster	--	--	2	<0.1	1	0.1	3	<0.1
Nephronaias sp.	Pearly mussel	10	0.8	828	11.0	252	15.7	1,090	10.6
Bivalvia (marine)	Marine bivalves	--	--	3	<0.1	--	--	3	<0.1
Prunum sp.	Margin snail	6	0.5	28	0.4	--	--	34	0.3
Melongena sp.	Crown conch	--	--	2	<0.1	--	--	2	<0.1
Americoliva sp.	Olive snails	1	0.1	10	0.1	1	0.1	12	0.1
Lobatus gigas	Queen conch	--	--	1	<0.1	--	--	1	<0.1
Strombus pugilis	Fighting conch	19	1.6	42	0.6	--	--	61	0.6
Strombidae	True conchs	161	13.3	2,376	31.7	134	8.3	2,671	25.9
Euglandina sp.	Wolf snail	--	--	12	0.2	1	0.1	13	0.1
Pachychilus glaphyrus	*Jute* snail	15	1.2	57	0.8	--	--	72	0.7
Pachychilus indiorum	*Jute* snail	9	0.7	33	0.4	--	--	42	0.4
Pachychilus sp.	*Jute* snail	--	--	111	1.5	3	0.2	114	1.1
Pomacea flagellata	Apple snail	1	0.1	113	1.5	7	0.4	121	1.2
Gastropoda (marine)	Marine univalves	474	39.1	2,002	26.7	1	0.1	2,477	24.0
Gastropoda (land snail)	Land snails	--	--	2	<0.1	--	--	2	<0.1
Dentalium sp.	Tusk shell	4	0.3	15	0.2	--	--	19	0.2
Total of identified invertebrates		700	57.7	5,638	75.2	400	24.9	6,738	65.3
Total NISP		1,213	100	7,501	100	1,606	100	10,320	100

specimens identified as large mammals are presumed to be white-tailed deer based on size and bone density. It was not possible to distinguish between the collared peccary (*Pecari tajacu*) and white-lipped peccary (*Tayassu pecari*) due to the difficulties of osteologically separating the two taxa and the small number of specimens available in the comparative collections used by the authors. The armadillo is also common. Although NISP overestimates the abundance of this animal in the late Mai assemblage due to its large number of bony osteoderms, the abundance of long bone fragments in both early and late Mai samples suggests that it was an important animal for the Pacbitun Maya. Carnivores are rare but form a diverse group: dog, weasel (*Mustela frenata*), puma (*Puma concolor*), jaguar (*Panthera onca*), margay (*Leopardus wiedii*), and ocelot (*Leopardus pardalis*). Other rare mammals include opossum (*Didelphis virginiana*, *Didelphis marsupialis*), pocket gopher (*Orthogeomys* sp.), tapir (*Tapirella bairdii*), paca, agouti, and rabbit (*Sylvilagus* sp.).

Reptiles are the second most important class. This group is dominated by turtle carapace or plastron fragments lacking taxonomically diagnostic features. Only one specimen was specifically identified as a small mud turtle (*Kinosternon* sp.). Because of the numerous bony parts of the shell that preserve well and are easily identifiable, turtles are overrepresented by NISP counts. Snakes are the second most common reptile group. One colubrid specimen dates to the early Mai phase while five colubrid and three crotaline specimens are found in the late Mai assemblage. Iguana is the only lizard identified in the assemblages. The amphibian assemblage is composed of a single bone from a cane toad (*Rhinella marina*) dating to the late Mai phase.

Fish remains are rare in Plaza B, although both freshwater and marine species are represented. In the early Mai assemblage, catfishes (Ictaluridae) and serranids are represented by one specimen each. One specimen of parrotfish (*Sparisoma* sp.) was identified in the late Mai sample.

Bird remains are also uncommon. Only one specimen of a galliform bird was identified in the late Mai assemblage. However, the size of the unidentified specimens suggests the presence of medium- to large-sized birds, most likely turkeys (*Meleagris* sp.) or other gallinaceous birds.

Shell remains are very abundant in Plaza B, with a total of 7,909 remains, of which 1,260 date to the early Mai phase and 6,649 specimens to the late Mai phase. We present here the combined abundances of specimens recovered from the 1995-1997 (Hohmann 2002:Table 6.1) and 2017 excavations (unpublished data). Taxonomic analysis of the invertebrate remains from the 2008-2009 excavations is ongoing. Most of the invertebrate specimens were identified to class level or below, for a NISP of 6,338. The invertebrate assemblage is better preserved than the vertebrate remains. In general, shell tends to fare better than bone in highly acidic soil conditions as a result of their calcium carbonate composition (Hohmann 2002:46).

Fourteen taxa were identified across three classes: Gastropoda (62.8 percent), Bivalvia (9.7 percent), and Scaphopoda (0.2 percent).

Gastropods are by far the most common shell group recovered from Plaza B. They are represented by nine species and one family. Most gastropods are true conchs (Strombidae), with 61 specimens identified as fighting conch (*Strombus pugilis*) and one as queen conch (*Lobatus gigas*). Other marine gastropods present in smaller quantities (<0.5 percent) include the margin snail (*Prunum* sp.), olive snail (*Americoliva* sp.), and crown conch (*Melongena* sp.). The latter species is only found in the late Mai assemblage. At least 25 percent of shell specimens could only be identified as marine gastropod due to high fragmentation.

Freshwater gastropods were also identified. Although only represented by one specimen in the early Mai assemblage, apple snails (*Pomacea flagellata*) are more numerous in the late Mai sample. The same pattern is seen for the *jute* snail, represented by two species: *Pachychilus glaphyrus* and *P. indiorum*. The importance of *jute* at Pacbitun is underrepresented in this study, as more than 330,000 specimens of this genus have been recovered from Mai deposits. They were not included in the NISP counts as the taxonomic analysis is on-going. One species of land snail was identified: the carnivorous wolf snail (*Euglandina* sp.).

The most common bivalve is the freshwater pearly mussel (*Nephronaias* sp.). It is very abundant in the late Mai assemblage while only ten specimens were identified from the early Mai phase. Remains of one ark clam (*Arca* sp.) and two thorny oysters (*Spondylus* sp.) date to the late Mai assemblage.

Scaphopods are represented at Pacbitun by a few specimens of *Dentalium* sp. in both early and late Mai assemblages.

Plaza A

A total of 1,631 specimens were recovered in the late Mai assemblage of El Quemado, in Plaza A (Table 4.1). The vertebrate assemblage is composed of 1,229 specimens. Most of these were identified below class level, for a total NISP of 1,206 (Table 4.2). The relatively poor preservation substantially affected the identification of the vertebrate remains. Only 115 specimens were identified to family or lower taxonomic level while most specimens consist of unidentified mammal remains (*n* = 1,045, 65.1 percent). Eighteen taxa were identified from four classes (Actinopterygii, Reptilia, Aves, and Mammalia). Using NISP counts, mammals are the most commonly identified animals (72.7 percent), followed by birds (1.1 percent), reptiles (0.9 percent), and fish (0.4 percent).

Mammals are represented by 12 taxa and at least six species. The most frequently identified animals are artiodactyls: white-tailed deer, brocket deer, and peccaries. Second in importance are rodents, identified as paca, or paca/agouti. Most of the unidentified rodents are large specimens that likely belong to these two species, or possibly pocket gopher. Armadillos are represented by four bone scutes. All other mammalian taxa represent less than 0.1 percent of the faunal assemblage: opossums (Didelphinae), carnivores (Carnivora), cats (Felidae), and rabbits.

Birds are second in importance. Although no specimen could be identified below class level, specimen size suggests the presence of medium- to large-sized birds. Reptiles are represented by unidentified turtle carapace and plastron remains too fragmented to be identified to species or family. However, turtles of small, medium, and large size are present. Finally, fish form a very small portion of the assemblage, with one specimen identified to the bay snook (*Petenia splendida*), a freshwater species.

The identified invertebrate assemblage is much smaller than the vertebrate assemblage, with only 400 specimens (24.9 percent) represented by at least seven species from two classes: Bivalvia (15.8 percent) and Gastropoda (9.2 percent). Bivalves are most abundant due to large quantities of freshwater pearly mussel (15.7 percent). One *Spondylus* shell is the only marine bivalve. Gastropods are represented by large quantities of marine conchs, one specimen of olive shell and another of the terrestrial wolf snail, and a few freshwater *jute* and apple snails.

Modified Remains

Evidence of crafting has been identified at Pacbitun, with bone and shell artefacts recovered from both Plazas A and B. A total of 64 bones and 6,910 shells are modified, representing 0.3 percent of the Plaza A assemblage and 56.6 percent in Plaza B (Table 4.3).

Table 4.3. Taxonomic distribution of artefact types by time period and context.

Taxon	Bead	Rasp	Weaving implement	Polished	Debitage	Total
Plaza B early Mai phase						
Tayassuidae	--	--	--	1	--	1
Odocoileus virginianus	--	--	--	--	1	1
Mammalia (large)	--	--	1	--	--	1

Mammalia	--	--	1	1	--	2
Nephronaias sp.	6	--	--	--	--	6
Prunum sp.	6	--	--	--	--	6
Americoliva sp.	1	--	--	--	--	1
Strombus pugilis	19	--	--	--	--	19
Strombidae	146	--	--	--	15	161
Pachychilus glaphyrus	15	--	--	--	--	15
Pachychilus indiorum	9	--	--	--	--	9
Gastropoda (marine)	474	--	--	--	--	474
Dentalium sp.	4	--	--	--	--	4
Mollusca	1	--	--	--	559	560
Total	681	0	2	2	575	1,260
Plaza B late Mai phase						
Puma concolor	--	--	--	--	1	1
Mammalia (small-medium)	--	--	--	1	--	1
Mammalia (medium-large)	--	--	--	12	12	24
Mammalia (large)	--	--	--	--	1	1
Mammalia	1	--	--	--	--	1
Melongena sp.	2	--	--	--	--	2
Mollusca	13	--	--	--	997	1,010
Mollusca (riverine)	1	--	--	--	--	1
Spondylus sp.	2	--	--	--	--	2
Nephronaias sp.	59	--	--	--	--	59
Bivalvia (marine)	3	--	--	--	--	3
Prunum sp.	28	--	--	--	--	28
Americoliva sp.	9	--	--	--	--	9
Lobatus gigas	1	--	--	--	--	1
Strombus pugilis	42	--	--	--	--	42
Strombidae	1,011	--	--	--	1,365	2,376
Pachychilus glaphyrus	57	--	--	--	--	57
Pachychilus indiorum	33	--	--	--	--	33
Pachychilus sp.	4	--	--	--	--	4
Pomacea flagellata	1	--	--	--	--	1
Gastropoda (marine)	1,997	--	--	2	3	2,002
Dentalium sp.	15	--	--	--	--	15
Total	3,279	0	0	15	2,379	5,673
Plaza A late Mai phase						
Odocoileus virginianus	--	1	--	1	1	3
Cervidae	--	--	--	--	1	1
Mammalia (medium-large)	--	--	--	1	1	2
Mammalia (large)	--	2	--	--	16	18
Mammalia	--	--	3	--	1	4
Vertebrata	2	--	1	--	--	3
Nephronaias sp.	1	--	--	--	--	1
Strombidae	8	--	--	--	--	8
Gastropoda	--	--	--	1	--	1
Total	11	3	4	3	20	41
Grand total	3,971	3	6	20	2,974	6,974

Finished and nearly finished objects made from bone were found in Plaza A. These include: one rasp made from a white-tailed deer metatarsal and two from medium-large mammal long bones, a needle with a perforated eye made from a mammal long bone, two needles or pins made from a mammal long bone and an unidentified vertebrate long bone, an awl made from a mammal long bone, a possible bead made from bird bone, and a bone bead made from an unknown vertebrate taxon. The recovery of 18 debitage fragments of medium and large mammal bone suggests that several of the bone artefacts could have been manufactured on site. Possibly unfinished artefacts include a white-tailed deer metacarpal of which one of the ends was cut and snapped, and a mammal long bone with one bevelled end. Polish was also identified on a white-tailed deer antler and a mammal long bone; the function of these objects is unknown. The polish may result from use-wear or may have been an intentional modification of these remains.

Finished bone artefacts are less common in Plaza B, as only two formal objects were identified. They consist of an awl made from a large mammal long bone and a pin from an unidentified mammal bone. However, other specimens bear traces of manufacture. Several mammal long bone fragments show evidence of debitage (*n* = 15) and polishing (*n* = 15). This includes a polished peccary radius and the cut distal metaphysis of a puma. The latter was cut transversely on its proximal edge, likely to detach the epiphysis from the shaft. It appears to have been separated from the shaft using the ‘groove and snap’ technique (Emery 2008).

The extensive shell artefact assemblage found in Plaza B has already been reported elsewhere (Hohmann 2014; Hohmann *et al*. 2018). A total of 5,670 modified shell specimens and 3,113 fragments of marine shell detritus were recovered in Mai deposits (see Figures 3.4, 3.9). We report here an additional 2,155 shell specimens, including 698 beads recovered during the 2017 excavations of Sub-Structure B3 and surrounding areas in Plaza B (Table 4.4). Future analysis is necessary to classify the newly excavated beads into formal types. However, preliminary taxonomic identification of these remains is completed. The majority are made from the marine conch (96.8 percent), with an additional two perforated whole olive shell, ten perforated pearly mussels, and five perforated *jute* snails. Most unidentified marine gastropod and conch (Strombidae) specimens are likely shell detritus, that is, waste resulting from the shaping of a shell that is not intentionally worked.

In contrast to Plaza B, only nine shell beads were recovered from El Quemado. Eight were made from conch, including one identified as being made from the shoulder of a *Strombus* shell. One bead is made from the freshwater *Nephronaias*. A gastropod specimen also appears polished.

Animal Resource Use

During the Middle Preclassic, the Pacbitun Maya exploited a relatively diverse set of animal resources, with 32 vertebrate and 14 invertebrate taxa identified to family level or below. When considering the Plaza A and B assemblages as a whole, deer and peccaries were favoured, with white-tailed deer being the prey of choice. Deer was a ubiquitous resource at Maya sites. It was used as a source of food, hide, and tools, and held symbolic importance (Montero López 2009; Pohl 1983). In contrast to deer, most mammals of small and intermediate size are rare, except for the armadillo. This animal may have been preferred not for the meat it can provide but for its fat. During the wet season, the armadillo can build an extremely thick layer of fat relative to its body size (Hill *et al*. 1984). This characteristic could make it more desirable than other small- and medium-sized mammals that tend to be much leaner. Similarly, turtles are abundant (although most likely overrepresented by NISP counts), likely because they can easily be acquired when emerging from aestivation or with nets (Legler and Vogt 2013).

Birds and fish do not appear to have been important resources at Pacbitun. This pattern contrasts with the high quantities of these taxa at other Middle Preclassic sites, such as Cahal Pech (Powis *et al*. 1999), Cuello (Fradkin and Carr 2003; Wing and Scudder 1991), and K’axob (Masson 2004). However, the former site is located on the Belize River while the latter two are found in wetland areas. Thus, the residents from these sites enjoyed more direct access to riverine and wetland habitats than the Pacbitun population, which could explain the lower abundances of these taxa. Screening protocol may also be a factor impacting the recovery of bird and fish remains. However, the taxonomic diversity of assemblages recovered with 1/4-inch and 1/16-inch mesh screen in Plaza B was not statistically different (Kolmogorov-Smirnov $D = 0.45$, $p = 0.147$). Given the relatively poor preservation of the vertebrate assemblage, it is also possible that remains from these taxonomic groups did not preserve well; bird and fish tend to weather more quickly than mammal bones (Cruz 2008; Lubinski 1996). They may also have been discarded

Table 4.4. Counts of modified shell and detritus in Plaza B by time period and excavation project.

Years of excavation	early Mai phase		late Mai phase		Mai phase	Total
	1995-1997	2017	1995-1997	2017	2008-2009	
Modified shells	676	5	2,585	693	2,409	6,368
Shell detritus	559	15	920	1,442	1,634	4,570
Total	1,235	20	3,505	2,135	4,043	10,938

in a location further away from the households that was not captured by the excavation units.

In Plaza B, the recovery of faunal remains in floor deposits and alleyways around the platforms suggests that animals were used in domestic activities. The presence of cut marks (n = 8), burning (n = 39), percussion notches (n = 4), and spiral fractures (n = 107) on a small portion of the remains suggests use as food. Some of the bones and most of the shell were also used for crafting (see crafting section below). In Plaza A, a few specimens also exhibit cut marks (n = 2), burning (n = 26), and spiral fractures (n = 12), suggesting that animals were consumed for the meat, marrow, and fat that they provided, possibly as parts of ceremonies.

One animal notably rare in the Pacbitun assemblage is dog. Research suggests that dogs were important food items and ritual actors during the Preclassic. At Cuello, dogs were a reliable source of food based on their age distribution, presence of butchery marks, and fracture patterns (Clutton-Brock and Hammond 1994), and some of them may have been consumed during feasting events (Shaw 1999). At Colha, carbon isotope analysis revealed that dogs from ritual deposits were purposefully fed maize, contrasting with dogs from midden contexts that exhibited an isotopic signature indicative of scavenging and feeding on table scraps (White *et al*. 2001). At Ceibal, strontium isotope analysis identified two non-local dogs interred in the Central Precinct, the political and ceremonial core of the site (Sharpe *et al*. 2018). The animals may have entered at the site through trade or as traveller's companions and were possibly included in ritual events. Similarly, dogs were interred in elite burials and associated with ceremonial contexts at Kaminaljuyu (Emery *et al*. 2013). Despite evidence for the consumption and possible ritual manipulation of dogs at several Preclassic Maya sites, dogs were not heavily used at Middle Preclassic Pacbitun, where only two specimens were identified. This pattern appears consistent with other sites in the broader Belize River Valley, where dogs are rare in both Preclassic and Classic assemblages (Powis *et al*. 1999; Stanchly and Awe 2015). In fact, a review of the Maya zooarchaeological record of dogs indicates a highly variable use of the animal across time and space, suggesting that dogs played various roles as food, ritual offering, hunter, companion, and symbol in the Maya society (Cunningham *et al*. 2020).

Shell was an important resource exploited by the Pacbitun Maya. Four species were favoured: conch, pearly mussel, apple snail, and *jute*. Most of the conch is worked; its use in crafting by the Pacbitun Maya is discussed below. In contrast, apple snails, pearly mussels, and *jute* remains are generally not modified. This triad of freshwater molluscs is often considered supplementary food due to low nutritional returns (Moholy-Nagy 1978; Powis 2004). However, the freshwater molluscs commonly appear at Preclassic sites in middens and construction core contexts, such as Blackman Eddy (Garber *et al*. 2004b), Blue Creek (Stanchly 2016b), Cahal Pech (Healy *et al*. 2004c; Powis *et al*. 1999), Ka'Kabish (Stanchly 2013), K'axob (Harrigan 2004), and Minanha (Solis 2011). Thus, this mollusc possibly had some dietary importance for the early Maya (Stanchly and Burke 2018). At Pacbitun, the *jute* stands out as the preferred freshwater mollusc, with more than 330,000 specimens found in an area measuring 225 m^2 in Plaza B. This represents an average yield of 1,467 *jute* per square metre. When this figure is extrapolated to assess the number of *jute* that may be present within Mai deposits throughout Plaza B, we arrive at an estimate of more than 4.9 million *jute*. This is a considerable quantity of shell, which has implications for Maya exploitation of *jute* during the Mai phase.

Traditionally, the presence of *jute* at Maya sites has been interpreted as food, although one of marginal importance due to the snail's low caloric value and the energy required for its preparation (Healy *et al*. 1990). The presence of a broken or punctured spire, which severs the snail's muscle attachment from its shell, is considered evidence of this. However, natural processes and bird predation can alter the shells in a fashion similar to the patterns created by cultural activities (Solis 2011:92–94). Therefore, broken spires are not unequivocal evidence of human consumption of *jute*, as frequently argued in the Maya literature. Alternatively, the *jute* could have been used as construction material (Solis 2011). The shells could have been re-used as fill after discard, or accidentally collected during the dredging of river bottoms for muck, an important material used as a wet core aggregate for large-scale plaza construction. The latter practice would result in a deposit filled with *jute* but with few associated artefacts. Large amounts of *jute* may also result from feasting events. At Chan, more than 100,000 *jute* were recovered in a re-deposited Preclassic midden (Keller 2012). Use as food is argued given the punctured or cut spires of nearly all analysed specimens. The enormous quantities of shells suggest repeated communal gatherings during which Chan's Preclassic ruling members may have solidified their emerging authority. During the Late Classic, the ruling elite of the site redeposited these shells around their elevated platform residences. Although the meaning of this event is unknown, it has a clear symbolic quality. Similarly, the deposition of large quantities of *jute* in cave burials and caches is interpreted as having symbolic importance associated with the concepts of water, renewal, and fertility (Halperin *et al*. 2003).

At Pacbitun, all specimens in a sub-sample of 225 *jute* remains present a broken apex or punctured spire. Given that most of the shells are found within midden contexts, in association with ceramic, lithic and other faunal materials, we suggest that *jute* was consumed as a food item and later re-purposed as part of middens as construction material. Given this interpretation, the vast quantities of *jute* at Pacbitun also imply that the snail played more than a role as supplementary food during the Preclassic, as suggested at Chan.

Habitat Use and Trade

Nearly all animals exploited by the Pacbitun Maya during the Middle Preclassic can be found in local habitats, except for the marine fish and molluscs. This interpretation assumes that animals that can be found near Pacbitun were not traded in from other sites. Freiwald (2010) and Thornton (2011) have shown that animal resources previously thought to have been locally acquired because of their ubiquity on the landscape (e.g., deer and peccary) were traded among Maya communities during the Classic and Postclassic periods, possibly as part of exchange networks or as tribute items. It is possible that animals were traded in similar ways in earlier times, as suggested by the presence of non-local dogs at Preclassic Ceibal (Sharpe *et al*. 2018). Nonetheless, given the relative paucity of exotic animals at Pacbitun, it can safely be assumed that most animal resources were locally acquired.

Habitat fidelity analysis allows us to refine our analysis of habitat use. Animals in the tropics can thrive in a variety of habitats. As a result, habitat fidelity analysis assigns values to animal taxa as a function of their fidelity (or time spent) in different types of habitats, which are multiplied by NISP counts (for values used in this study, see Emery and Thornton 2014). Habitats considered in this analysis include closed canopy forest, secondary/disturbed forest, riverine/lacustrine habitats, wetlands, agricultural/open areas, and residential areas. The analysis includes vertebrates (i.e., mammals, birds, reptiles, and amphibians) identified to species or genus in Plazas A and B.

The habitat fidelity analysis reveals that the Pacbitun Maya mainly exploited animals from secondary or disturbed forests (41.4 percent) and agricultural fields (37.3 percent), which is not unexpected (Figure 4.1). The practice of agriculture likely resulted in the partial deforestation of the landscape, creating areas of second-growth vegetation that acted as a transition between undisturbed canopy forests and open cultivated areas; edge-browsers such as white-tailed deer frequent this habitat. Many animals are also attracted to this patchy environment because it provides cover during the day and access to agricultural fields and household gardens at night. The high fidelity values for secondary forests and agricultural areas also suggest that the Pacbitun Maya engaged in opportunistic hunting. Nonetheless, they likely organised hunting trips to closed canopy forests, as animals that primarily frequent this habitat, such as the brocket deer, white-lipped peccary, and wild cats, are relatively abundant (16.8 percent).

Based on the vertebrate data, riverine and wetland habitats were not extensively exploited, which is unexpected. The closest large waterway, the Macal River, is located about 4-4.5 km away from Pacbitun and would have provided access to a wide array of resources. Many streams, freshwater creeks, and springs are found within walking distance of the site, and a permanent waterhole was located at Pacbitun in antiquity. However, most of

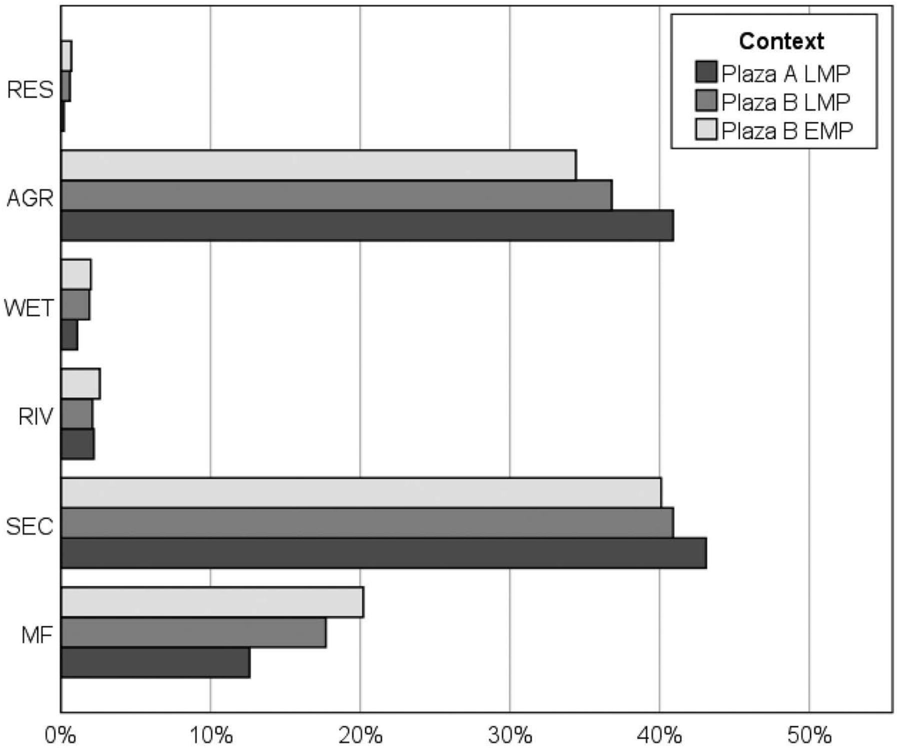

Figure 4.1. Habitat fidelity analysis for mammals, birds, amphibians, and reptiles in the early Mai phase (EMP) and late Mai phase (LMP) assemblages of Plazas A and B. Abbreviations: MF = mature/closed canopy forest, SEC = secondary/disturbed forest, RIV = riverine or lacustrine habitats, WET = wetlands, bajos, and swamps, AGR = habitats with low arboreal vegetation, including savannas and agricultural fields, and RES = residential areas.

these water sources would not support fish populations, although they may attract several species of amphibians, reptiles, and molluscs. Overall, the vertebrate fauna does not suggest exploitation of riverine and wetland habitats, but the invertebrate fauna does. The vast quantities of *jute*, apple snails, and pearly mussels recovered from Plaza A and B deposits attest to the exploitation of freshwater habitats, as all three molluscs could have been collected from the same rivers and streams. Habitat use during the early and late Mai phases was similar, as it was between contexts (one-way ANOVA $F(2, 15) = 0.383$, $p = 0.688$).

A few exotic vertebrates and the vast quantities of marine molluscs also attest to the exploitation of non-local habitats. Marine resources such as grouper, parrotfish, olive shell, margin shell, crown conch, queen conch, fighting conch, ark clam, thorny oyster, and tusk shell could all have been acquired from the Caribbean coast. Although the Pacbitun Maya possibly made the trip to the Caribbean Coast, around 100 km east of the site, to acquire these resources themselves, they more likely participated in long-distance exchange networks. The presence of other exotic materials at the site supports this interpretation: greenstone from the Motagua River Valley of Guatemala (~150 km) and obsidian from the Guatemala Highlands (400–500 km). Other inland sites also enjoyed access to marine animal resources, such as Cahal Pech (Powis *et al.* 1999), Ceibal (Sharpe 2019), Cuello (Fradkin and Carr 2003; Wing and Scudder 1991), and Tikal (Moholy-Nagy 1998). Overall, the presence of marine shell and fish at the distant inland site of Pacbitun indicates knowledge of and access to coastal resources as early as the early Middle Preclassic.

Crafting

The Middle Preclassic Maya of Pacbitun engaged in the production of bone and shell objects. The predominance of awls, pins, and needles in the modified bone assemblage of both Plazas A and B points to the production of objects associated with weaving, brocading, or hide working. However, the objects may have had other functions such as fibula (a pin used to fasten clothing), painting tools, hairpins, or cornhuskers (Halperin 2008; Healy *et al.* 2014). The small quantity of artefacts and bone debris does not suggest a large-scale production, but rather manufacture and use at the household and/or community level. Finished objects were more abundant in deposits associated with the public ceremonial structure of El Quemado. Although this may suggest preferential use of weaving implements for ceremonial purposes, the minimal number of these artefacts recovered at Q ($n = 4$) hints at a very occasional use of awls, pins, and needles in public events.

Other modified bone remains hint at the possible exploitation of feline remains for pelts and/or artefact manufacturing. Although relatively rare at Pacbitun, felines are diverse in the faunal assemblage. Cats, in particular, the jaguar, were ritually and symbolically important animals for the Classic Maya and other Mesoamerican groups (Benson 1998; Sugiyama *et al.* 2015, 2018). Bones of large felines were used in artefact manufacture (Emery 2008), and rulers and priests wore their skins and teeth as a symbol of high social status (Pohl 1983). Recent studies at Ceibal and San Bartolo suggest that these animals also played a role in promoting social and political positions within early Maya communities (Sharpe *et al.* 2014, 2018) and this may have been the case at Pacbitun during times of emerging socio-political complexity.

Seven feline remains were recovered at Pacbitun: one in Plaza A and six in Plaza B. Skeletal patterns can provide evidence for the production of pelts; phalanges, metapodials, and caudal vertebrae may be left with the pelt when fur-bearing animals are skinned (Fairnell 2008). Four of the six feline elements recovered in Plaza B fall within this category: one jaguar phalanx, one small felid phalanx, one margay navicular, and one small felid caudal vertebra. The puma phalanx displays three sets of deep cutmarks. However, those most likely result from the disarticulation rather than skinning of the foot. Overall, this small sample size prevents concluding that pelt exploitation took place in Plaza B. However, these remains, as well as a modified puma humerus from Plaza B and a feline canine found in El Quemado, point to the exploitation of large felines. Although the limited Pacbitun feline assemblage does not provide clear evidence for the ritual use of cats like at other Middle Preclassic sites, it supports the manipulation of dangerous animals early in time.

Bone manufacturing was part of the life of the Middle Preclassic residents of Pacbitun. However, it was a marginal activity in comparison to the shell bead manufacturing that took place in Plaza B. The 2017 excavation of Sub-Structure B3 provides additional data about shell production at Pacbitun. This shell sub-assemblage, dating to the late Mai phase, includes 693 small disc shell beads and 1,442 shell detritus (Table 4.4). Evidence for *in situ* bead manufacturing includes the presence of all parts of Strombidae shells, debitage fragments, and finished products. These findings resemble the characteristics of the shell industry previously identified at contemporaneous Sub-Structure B2, which also served as a production locale for crafting shell beads. As noted by Hohmann (2014), counts of shell beads and detritus per time period suggests an intensification in shell ornament production from the early to the late Mai phases (Table 4.4). Beads also became more standardised over time. While irregular beads dominate the early Mai assemblage, disc beads were increasingly more common, and their size and shape became more uniform during the late Mai phase.

Unlike Sub-Structure B2, shell manufacture at Sub-Structure B3 appears smaller in scale, with a lower frequency of shell beads, shell detritus, and chert microdrills. Interestingly, the quantity of shell beads associated with Sub-Structure B3 is considerably smaller than those found in Sub-Structure B2 while the amount of shell detritus is greater. It is unclear why the production between the two platforms differs, but it begs the question of whether different households in Plaza B held different roles in the production of shell beads. Different households participating in different stages of craft production are not uncommon at Maya sites, although most evidence dates to the Classic period. At Late Classic Colha, different stages of the manufacturing process of lithic artefacts were undertaken by workshops in distinct locales of the site (Masson 2001). Chert nodules were acquired and worked into blanks at group workshops located near procurement sites and quarries. The blanks were then transported and subsequently transformed into finished tools in work areas adjacent to individual households. At Aguateca, different elite households partook in separate stages of bone craft production. Refuse from the first stage of artefact reduction was only found in two elite residences, suggesting that initial production of bone artefacts was reserved to the residents of these structures (Emery and Aoyama 2007). However, the presence of production debris from second reduction and artefact finishing as well as tools with bone or shell use wear in most elite residences suggests that many elite households engaged in later stages of bone and shell artefact production. In contrast, the manufacturing sequence of jade artefacts was segmented between social groups at Cancuen. High-status commoner or lesser elite households were involved in the first stages of production, such as percussion, sawing, and drilling; elite households carried out the finishing stages of shaping, polishing, and incising, and owned the finished jade objects (Kovacevich 2011). At Pacbitun, the similarity in architecture and artefact content between Sub-Structures B2 and B3 suggests that the residents of these households were of comparable socio-political status. Differences in shell beads and debris may result from the two households specializing in different stages of the manufacturing process. Further categorisation of the shell remains into manufacture stages beyond ‘beads’ and ‘debris’ may shed light on this question.

Shell ornaments were symbolically important for the early Maya society. They are found in caches, burials, and other ritual offerings at several Preclassic Maya sites throughout the southern lowlands, such as Blackman Eddy (Cochran 2009), Ceibal (Sharpe 2019), K’axob (Isaza Aizpurúa and McAnany 1999), and Tikal (Moholy-Nagy 1997), in what could be characterised as a pan-lowland tradition. The residents of these sites also often engaged in the production of shell ornaments. At Pacbitun, Hohmann and colleagues (2018) argue that the sheer quantity of shell materials found in Plaza B exceeded household needs and, thus, that the production of shell ornaments was likely destined for intra- or extra-community exchange. The additional shell material recovered in 2017 from Sub-Structure B3 supports these interpretations while providing evidence for possible intra-community variation in shell bead production. The presence of a few beads at El Quemado also attests to the importance of shell beads in ritual contexts. However, it remains unclear whether the production and/or distribution of shell beads were controlled by an emerging elite that used them to create and maintain alliances; or, if access to the beads was available to all members of the community while certain individuals or groups were more successful in accumulating the resources to fulfil their social and/or ritual obligations.

The Emergence of Ritual Practice

During the early Mai phase, the residents of Plaza B engaged in domestic and crafting activities. The manufacture of shell beads intensified and became more standardised during the late Mai phase. During this time, the Pacbitun Maya erected a large ceremonial structure, El Quemado, in Plaza A. Given the differences in the nature of the activities carried out in Plazas A and B, we expect that faunal assemblages from the two locations differ from one another. At Preclassic and Classic Maya sites, the elite often participated in ritual performances, feasts, and other activities that involved animal taxa different from those used in domestic activities (Emery 2003; Montero López 2009; Sharpe and Emery 2015). Statistical analyses support this hypothesis in two out of three scenarios when faunal assemblages from different contexts (domestic Plaza B vs ceremonial Plaza A) and time periods (early and late Mai phases) are compared (Kruskal-Wallis $H(2) = 13.84$, $p < 0.001$). A posthoc evaluation indicates that the Plaza B early and late Mai assemblages are significantly different (Mann-Whitney $U = 1314$, $p = 0.001$), while the two late Mai assemblages also differ significantly from one another (Mann-Whitney $U = 1116$, $p < 0.001$). This suggests that the early Mai assemblage from Plaza B has a similar ordinal ranking of taxa as the late Mai assemblage from Plaza A.

During the late Mai phase, the taxonomic diversity is smaller in Plaza A than B, which may suggest a more specialised use of animals in the activities carried out at El Quemado. Deer, the preferred prey at Pacbitun, is the most abundant vertebrate in Plaza A. Deer often served as sacrificial victims in rites associated with fertility and renewal, such as events marking the end of calendrical cycles during the Classic and Postclassic (Montero López 2009; Pohl 1983), or during feasts (Koželsky 2005; Montero López 2013). A similar use is reported by Friar Diego de Landa during the Colonial period (Tozzer 1941:144). Deer legs and heads are also depicted as offering in the Maya codices (Pohl 1983; Seler 1996:220; Tozzer and Allen 1910:348–350). Deer were also a preferred food of the elite, who generally had differential access to the meatiest parts of the animal (Emery 2003; Sharpe and Emery 2015). Although we cannot assume that the Pacbitun Maya used deer remains for rituals or feasts of this type during the Middle Preclassic, these examples attest to the enduring use of deer for ceremonial purposes.

Patterns of skeletal distribution may shed light on the use of deer at Pacbitun. Apparent differences emerge in the distribution of deer skeletal elements recovered in and around the domestic households of Plaza B and the public ceremonial structure of El Quemado in Plaza A (Mann-Whitney $U = 60$, $p = 0.004$). In Plaza B, complete carcasses of deer are present (Figure 4.2). Long bones are frequent, with the humerus, femur, and metatarsal being the most

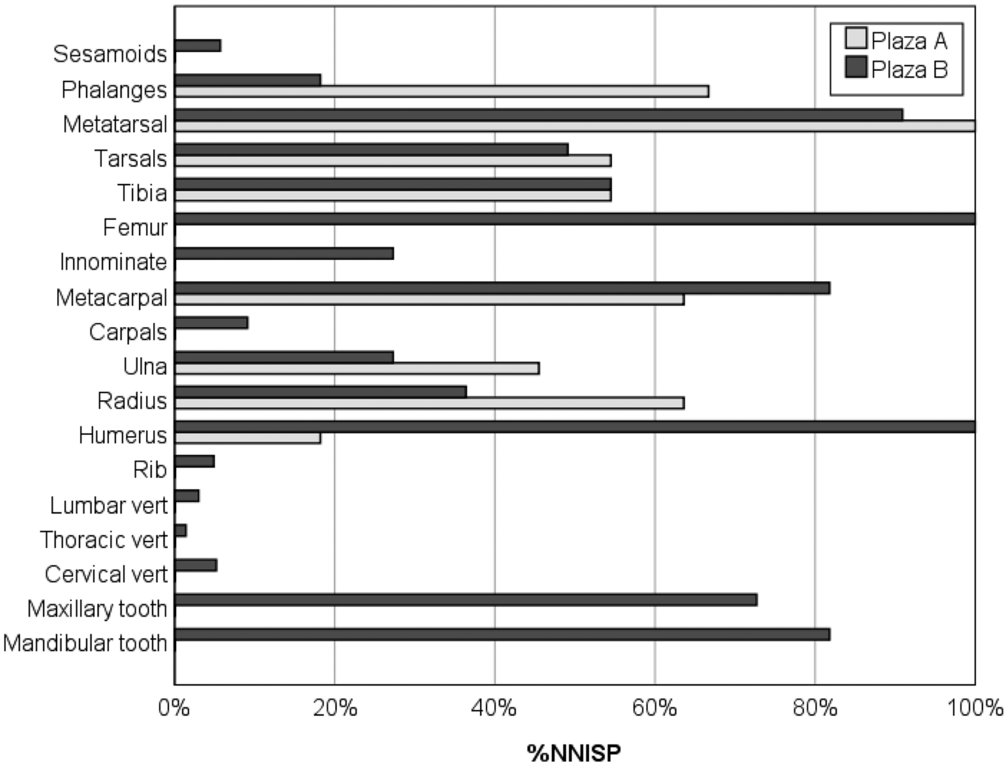

Figure 4.2. White-tailed deer body part representation in the Plazas A and B Mai assemblages at Pacbitun. Data is represented by Standardised Normed NISP (%NNISP). Normed NISP is obtained by dividing each skeletal element by the number of times it occurs in a skeleton. The NNISP for each element is then standardised by dividing all identified elements by the highest NNISP count, a method that facilitates comparisons of assemblages.

common. These elements provide the most significant amount of meat and marrow in a deer, and the straight and long metatarsal is a great raw material for bone artefact manufacturing. Elements that may be discarded at kill sites, such as those of the feet (19.9 percent) or cranium (11.6 percent), are relatively abundant. However, cranial elements are only represented by teeth, which may inflate their abundance in the assemblages as they are more durable than bone and are easily identified.

The skeletal pattern from the Plaza B households contrasts with the preference for limb elements, particularly the lower leg, at El Quemado. The metatarsal is the most common element, followed by the metacarpal, phalanges, and radius. No elements from the trunk (i.e., cranium, ribs, or vertebrae) were identified in this assemblage. This pattern differs from what is generally expected from ceremonial/ritual contexts, in which upper limbs are generally more common. The humerus and femur and, to a lesser extent, the radius-ulna and tibia, are considered the meatiest portions. In comparison, the lower limb (metapodials and phalanges) offers little meat, although the metapodials are a rich source of marrow. The latter elements tend to be better preserved and more easily identified in poorly preserved, fragmented assemblages such as that of Pacbitun. However, given that the faunal assemblage from Plaza B is in a similar state of preservation, differential preservation does not appear a satisfying explanation for the Plaza A skeletal pattern. The dearth of humerus and femur remains may suggest that these elements were reserved for other activities while other elements of the fore (radius-ulna, metacarpals, and phalanges) and hind (tibia, metatarsal, and phalanges) limbs were possibly used for ceremonial purposes, such as feasting events or animal sacrifices, by their association with Q.

Although the Plaza B sub-structures were the centre of domestic and crafting activities, they were not a space devoid of ritual activities. Some of the animals identified in this study may have been used for purposes other than food and artefact manufacturing, although traces of these activities are not readily apparent. One instance, however, is a cache of 50 irregular beads, likely strung together, found near a posthole of Sub-Structure B1 dating to the early Mai phase (Hohmann *et al*. 2018:136). As discussed above, shell beads played a significant social and/or ritual role within the Maya society. The data from Pacbitun suggests that this behaviour dates to as early as the early Middle Preclassic.

Differences in the use of invertebrates between the two plazas also demarcate them as different locales of the Pacbitun community during the late Mai phase. The invertebrate taxonomic diversity is much lower for El Quemado than the Plaza B households, once again suggesting a more specialised and restricted set of animals used for ceremonial purposes. The large quantities of worked shell and detritus in the Plaza B households contrast with the few worked beads found at El Quemado. The same can be said of the near absence of *jute* in Plaza A in comparison to the hundreds of thousands of these snails recovered in Plaza B. However, a substantial quantity of pearly mussels (15.7 percent of the Plaza A assemblage) was recovered from various sections of the imposing Q structure. The use of this mussel was possibly imbued with ritual significance for the Preclassic Maya through its association with water (Powis 2004). Although more commonly found in domestic contexts and middens, this mussel has been associated with ritual contexts during the Preclassic, appearing in unworked and worked form in caches and burials (Buttles 2002:173; Hammond 1991:185-186). Given that the pearly mussel is the most abundant invertebrate at El Quemado, we tentatively conclude that it was symbolically used either during rituals or the construction of the structure.

Conclusions

The Middle Preclassic Maya of Pacbitun exploited a narrow set of vertebrate resources but considerable amounts of invertebrate animals. Deer, peccary, and armadillo were the preferred vertebrates while conch and a triad of freshwater molluscs (*jute*, apple snail, and pearly mussels) constituted the favoured invertebrates. Most resources were acquired from local habitats, more particularly secondary forests and agricultural fields, which suggests opportunistic hunting. Resources easily collected en masse in riverine and lacustrine habitats were also abundant, such as turtles, and freshwater snails and mussels. Large quantities of marine shell used for bead manufacturing, as well as a few marine fish, attest to the participation of the Pacbitun Maya in long-distance exchange networks.

Most resources appear to have been exploited for food. However, other uses as construction fill (e.g., *jute*) and raw material for crafting (e.g., marine shell, large mammal bone) were also identified. Bone manufacturing hints at a modest production of weaving implements for household- or community-level needs. In contrast, the large-scale production of disc shell beads suggests manufacture for intra- or extra-community exchange. New evidence presented in this study hints at variation in manufacturing intensity among households. We suggest that varying abundances of finished products and shell detritus may correspond to the participation of different households in different stages of the manufacturing process; or may attest to the differing success of various households in manufacturing shell products. The Pacbitun shell disc production possibly sustained the needs of an emerging elite class that relied on the acquisition and possible distribution of shell beads to affirm its social and political status. Presence of shell beads at El Quemado and in a cache in Plaza B also attests to the ritual significance of this material for the early Maya. In addition, unmodified and modified remains of felines suggest that the Pacbitun Maya manipulated dangerous animals early on. While the management of dog appears to have been one of the first ritual practices at several Preclassic sites, this was not the case at Pacbitun, where the animal is rare.

Despite this wealth of zooarchaeological data, it is not possible to determine who acquired animal resources and how these were distributed within the community during the Middle Preclassic: were resources acquired by household units, specialised hunters, or at markets? Did individuals or groups of individuals control the acquisition, production, and/or distribution of animal resources within the community? The data at hand does not allow us to answer these questions clearly. However, the faunal data does shed some light on ritual practices and changing space dynamics in the early Pacbitun community. Differences in taxonomic abundances and deer element frequencies between the Plaza B households and El Quemado suggest specialised use of animals for ceremonial purposes during the late Mai phase. In turn, this hints at a certain ‘control’ over the flow of animal resources within the Pacbitun community, although it is uncertain how this control was enacted and by whom. In this context, animals appear to have been one of several commodities selected for ritual practice in an increasingly complex Preclassic Maya society. Future work at Pacbitun may allow us to better document the life of the early residents of the site, possibly of different socio-political statuses, and how animal resources were used in social and economic relationships within the community. In particular, continuing analysis of faunal remains from Sub-Structure C2, a recently identified structure considered to be the first public ceremonial construction at Pacbitun during to the early Mai phase (see chapter three, this volume), and Sub-Structures A1, A2, and A3, three possible ceremonial platforms used during the late Mai phase, may shed more light on emerging ritual practices in the community during the Middle Preclassic.

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5

The Defining Attributes of Pacbitun's Belize Valley E Group Variant

George J. Micheletti

The distinct architectural configuration of the E Group complex has become one of the most well-recognised forms of Maya monumental architecture. This recognition has led to the identification of dozens of E Groups at sites in the southern Maya lowlands. Yet, as well-documented as this archetype has become, nearly a century of archaeological inquiry has yet to settle upon a shared primary E Group function. A recent study of E Groups in the Belize Valley region conducted by Jaime Awe and colleagues (2017) suggests that the proposed functions of the E Group complex are too often indiscriminately assigned to all assemblages designated and labelled as this archetype (Awe *et al*. 2017:414). Rather than only focus on identifying a few of the more well-known similarities, they believe that analysis should also highlight the variations on attributes such as form and function (Awe *et al*. 2017:414). This regional study re-evaluated archaeological data of Belize Valley E Groups and identified shared physical and functional attributes not typical of archetypal E Groups outside this region. The study determined that the assemblages appeared to function more as shrines for ancestor veneration. Due to these variances, the researchers believe the Belize Valley assemblages should be classified as an E Group variant and placed within a subcategory they termed an 'Eastern Triadic Assemblage,' henceforth referred to as ETA.

Included within the Belize Valley E Group investigation, the extensively excavated assemblage at Pacbitun was also found to exhibit all the unique attributes shared by their regional neighbours to the north and west, making them an obvious candidate for the ETA model. However, upon closer inspection, the presence of these attributes when examining the assemblage's construction history is not as straightforward as it appears from a comprehensive perspective. Thus, after detailing the attributes that define the E Group and ETA archetypes, this chapter will provide a chronological breakdown of the structures that compose Pacbitun's ceremonial assemblage from its initial construction to its final construction phase. The purpose of this breakdown is not to question Awe and colleague's (2017) accurate ETA assignation of Pacbitun's assemblage, but to identify and better understand the inception and development of the unique attributes presented by the Belize Valley study. As the summary will demonstrate, while the first few construction episodes of Pacbitun's assemblage clearly follows the ETA model, key attributes that differentiate the ETA from the E Group were not wholly present until after a Late Classic period (AD 550-800) construction event. The sudden and drastic physical and functional alterations of the Late Classic event seem to indicate that the assemblage had fully conformed to the ETA at this time. Therefore, this study suggests that Pacbitun's relationship with the Belize Valley may have intensified during the Late Classic period.

The E Group Complex and the Belize Valley Eastern Triadic Assemblage (ETA)

The E Group's categorization as a 'complex' is a reference to the multiple interrelated structures that compose its architectural whole. In the context of an architectural plaza group, the structures of an E Group complex would frame the east and west borders of plaza space. The western component is generally a single pyramidal structure that is square in plan and centred on the west plaza edge. In its most basic form, the E Group's eastern component is composed of a long, low, north-south oriented platform. Additions to this platform often included a central structure that may be flanked by two additional smaller structures. These additions helped to sub-divide the E Group into two categories known as the Uaxactun style and the Cenote style (Figure 5.1), referencing the distinct architectural

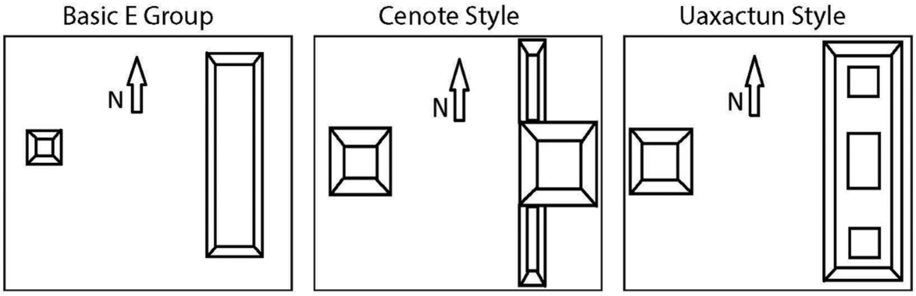


Figure 5.1. An illustration of the basic E Group, Cenote Style, and Uaxactun Style layouts (after Micheletti 2016: Figure 2 and 3).

form represented by the E Groups at these two sites (Chase and Chase 1995:99). Basically, the difference between these two styles can be found in the eastern component of the E Group. The Uaxactun style 'comprises a separate rectangular unit, usually about 70 m in length and supporting three buildings;' and in the Cenote style, 'the supporting platform is much longer and narrower and there is a focus on the squarish central pyramid which appears in plan to be appended to the much lower platform' (Chase and Chase 1995:93). An additional style known as the Cenote Variant was created to describe other E Groups 'having significant morphological differences' when compared to the Uaxactun and Cenote styles (Chase 1983:187; see also Aimers and Rice 2006:81). Spatially, as one of the earliest forms of monumental architecture, E Groups are often a site's central focus and are typically associated with open access plazas which has led researchers to believe these were locations for large communal gathering involving ceremonies and/or ritual performances (Aimers 1993; Chase and Chase 1995:100).

Interestingly, aside from the standard architectural theme and plaza configuration, E Groups have been found with little to no other universally shared physical and/or functional attributes. According to Awe and colleagues (2017:436), variations in architecture, features, and artefactual content can disrupt or negate certain functions commonly associated with E Group architecture. This is clearly demonstrated in their study of the E Groups of the Belize Valley.

The Maya region known as the Belize Valley is composed of several small to medium sized centres in west central Belize settled along the banks of the Belize River and its headwaters, the Macal and Mopan Rivers (see Figure 1.2). These centres are further categorised into an upper and central zone, which are geographically divided by the convergence of these headwaters (Chase and Garber 2004:1). Though Pacbitun lies beyond the limits of the Belize Valley, evidence of shared culture ties them to this region.

Pacbitun and six other Belize Valley sites with similar E Group arrangements were included in the study conducted by Awe and colleagues (2017). Like Pacbitun, the assemblages at Baking Pot, Blackman Eddy, Cahal Pech, Chan, El Pilar, and Xunantunich were investigated because each had undergone archaeological testing to some degree. Figure 5.2 illustrates each of the assemblages involved in the Belize Valley. At first glance, it is easy to understand how these assemblages could be classified as E Groups. Aside from some obvious variations on architectural style, their plaza configuration and general morphology appear to have all the basic elements that define the E Group archetype. However, the investigation by Awe and colleagues (2017:420-428) identified several important architectural discrepancies mostly associated with the eastern component of the ETA which they termed the Eastern Triadic Structure (ETS). One of the most significant structural inconsistencies of the Belize Valley assemblages is the missing eastern platform. Some of the more extensive excavations of these assemblages were able to expose the earliest phases of architecture discovering that the three structures of the eastern assemblage were not supported by a sub-structural platform—an integral E Group feature (Awe 1992, 2013; Awe *et al*. 2017:420-428; Healy 2004a:229; Meierhoff *et al*. 2004:37; Robin *et al*. 2008, 2012:119-120). These deep exposures also revealed that the eastern triadic formation had not been the initial configuration. In several cases, the central structure was the first eastern building to be constructed and would have sat alone for a short period of time. Constructed shortly after, the flanking structures were built as separate entities, unattached from the central structure. Subsequent modification(s) to these three structures caused each building to eventually grow together to form a single triadic assemblage (Awe *et al*. 2017).

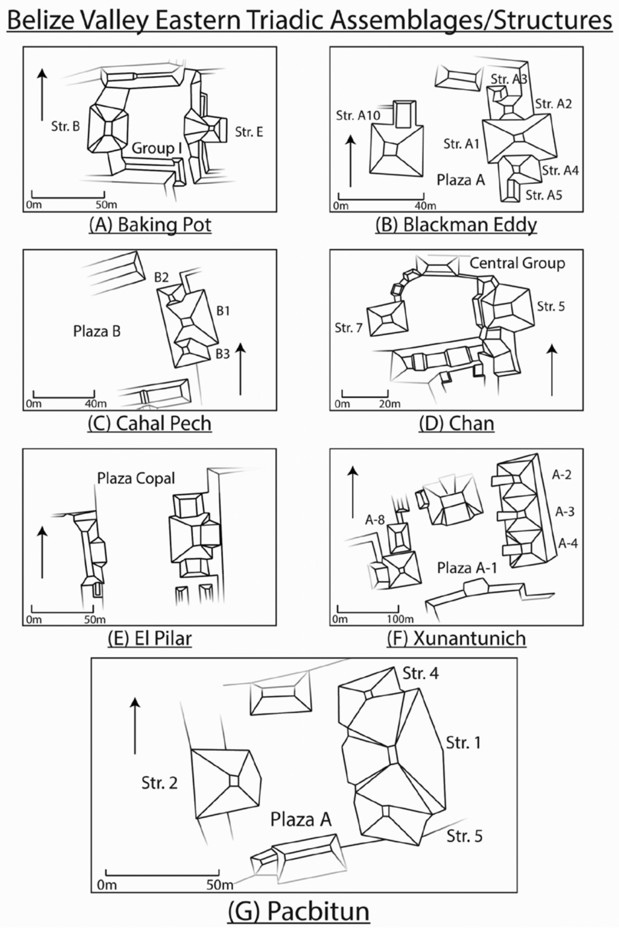


Figure 5.2. Illustrations of the architectural layout of Belize Valley Eastern Triadic Assemblages at; (A) Baking Pot (drawn from Conlon 1992), (B) Blackman Eddy (drawn from Garber *et al.* 2004:50, Figure 4.1), (C) Cahal Pech (drawn from Audet 2006:100, Figure 3.4), (D) Chan (drawn from Robin 2012:115, Figure 6.1), (E) El Pilar (drawn from Whittaker *et al.* 2009:136, Figure 2), (F) Xunantunich (drawn from LeCount and Yaeger 2010:6, Figure 1.2), (G) Pacbitun (drawn from Powis *et al.* 2017:192) (after Micheletti 2016: Figure 5).

After further examining the construction histories of the Eastern Triadic Structures, Awe and colleagues (2017:420-428) discovered that, in some cases, modifications to the three eastern structures did not occur simultaneously. For example, a specific construction event may have only renovated the central and southern structures leaving the northern building untouched. As a result, the total number of construction episodes often varied for all three eastern structures. Furthermore, these individual modifications rendered each building structurally unique with every construction episode crafting distinctive features and dimensions. Finally, as a result of these two construction practices, each eastern structure would grow at an uneven rate causing the assemblage as a whole to be nonsymmetrical (Awe *et al*. 2017:427). As Figure 5.3 (after Awe *et al*. 2017: Figure 13.2) exhibits, this lack of structural symmetry can still be observed in the profiles of the terminal architecture of many of the Eastern Triadic Structures of the Belize Valley. The figure also demonstrates that the assemblages at these centres do not appear to follow a shared regional construction protocol, as each assemblage appears to be unique to itself (Awe *et al*. 2017:420-422). On the other hand, modifications to the eastern platform and superstructures for the E Groups at Caracol and Uaxactun were typically simultaneous and uniform so that the eastern assemblage remained symmetrical (Chase and Chase 1987, 1995:98; Ricketson and Ricketson 1937). While this architectural discrepancy might not seem to warrant a new typology for the Belize Valley assemblage, when taking function into consideration, it is clear that the importance of architectural symmetry extends beyond an aesthetic value. Symmetry is one of several important features that would have once allowed the E Group to function as an astronomical observatory, the first and most widely accepted function of the complex (Aveni and Hartung 1986, 1989; Blom 1924; Ricketson and Ricketson 1937).

Using the western pyramid as an observation platform, the three eastern structures of E Groups acted as foresights positioned to mark the sun rise on solstices and equinoxes (Blom 1924; Ricketson and Ricketson 1937). Early

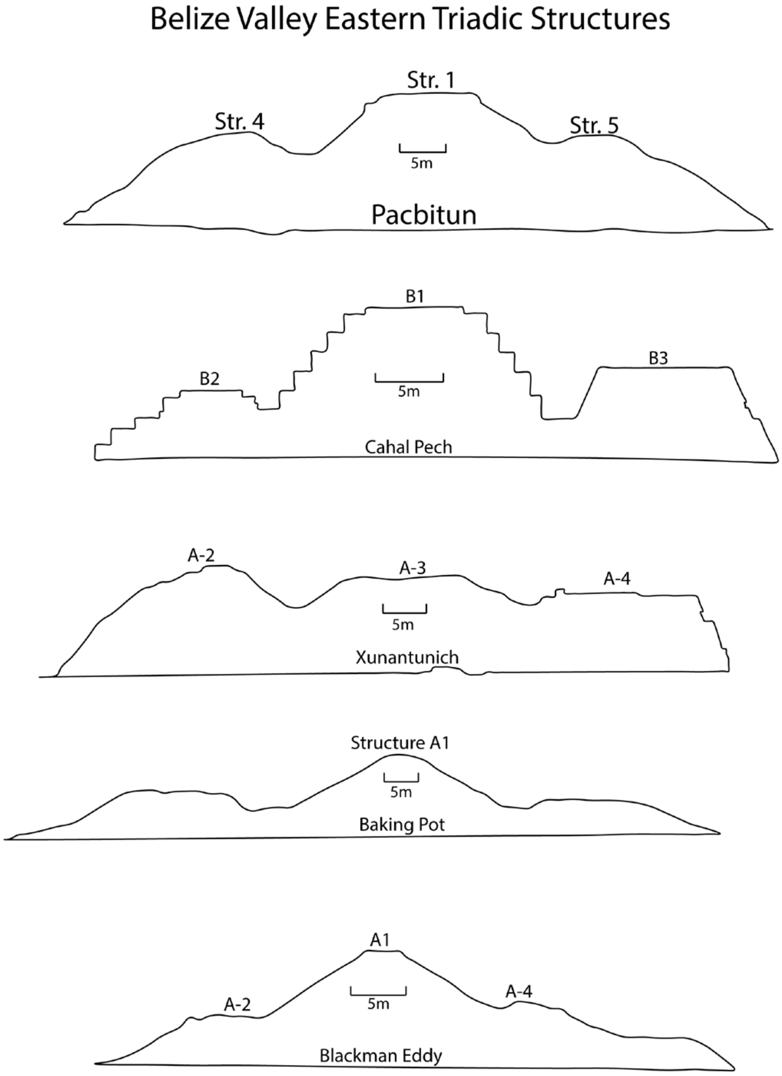


Figure 5.3. An illustration of the western face of the Eastern Triadic Structures at (top to bottom) Pacbitun, Cahal Pech, Xunantunich, Baking Pot, and Blackman Eddy showing the lack of architectural symmetry. Drawn by George J. Micheletti (after Awe *et al.* 2017: Figure 13.2).

alignment tests of E Groups found that many were not nearly as accurate at marking these significant solar events suggesting that the ideology and symbolism of the complex was more important than its astronomical accuracy (Ruppert and Denison 1943). However, the E Group's overall accuracy at marking solar extremes and other solar events such as zenith passages have led many to believe that early E Groups were functioning observatories (Aveni *et al*. 2003). On the other hand, as Awe *et al*. (2017:427) argue, the architectural variances of the Belize Valley assemblage appear to negate any astronomical function. Investigations testing the accuracy of the terminal architecture of the Belize Valley assemblages concluded that the unique construction patterns, orientations, and natural obstructions would not have allowed them to function properly (Aimers 1993; Aimers and Rice 2006:86; Awe *et al*. 2017:435-436). Additionally, the earlier phases of architecture were not tested for alignment accuracies during excavations and thus, cannot provide any evidence to support an astronomical function.

Two additional E Group functions known as the agricultural and trade scheduling hypotheses, both formulated by Rathje (1972; Rathje *et al*. 1978), are closely tied to the astronomical observatory hypothesis. These explanations suggest that the solar alignments of the E Group marked, or scheduled, important Maya cultivation and/or exchange events. In regard to the ETA, Awe and colleagues (2017:416) quickly discredit both explanations for the simple fact that the Belize Valley assemblages, like so many other designated E Groups, do not function as observatories or timekeeping devices.

Unwilling to abandon an alignment theory, John Carlson (1981) proposed that the E Groups that had failed to mark solar events may actually align with other significant celestial bodies or even important topographic features on the landscape, otherwise known as geomancy. While investigations by Doyle (2012), Inomata (2017), and Estrada-Belli (2017) have begun to give credence to this hypothesis, geomancy can be difficult to test and research concerning these types of E Group alignments is still in its infancy. For now, most believe that non-functioning E Groups merely acted as symbolic representations of solar observatories primarily built for communal gatherings to commemorate/celebrate agricultural rituals (Aimers 1993; Aveni *et al*. 2003; Cohodas 1980). Aimers and Rice (2006:92) have postulated that, while early E Groups likely tracked solar movements, observation had become 'obsolescent' by the end of the Late Preclassic period. Thus, the construction of non-functioning E Groups signals a de-emphasis of the complex's functional importance and an increased emphasis on symbolic ritual importance associated with commemorating significant annual dates pertaining to specific agricultural activities (Aimers and Rice 2006:92). The E Group's association with marking the passage of time is thought to correlate well with valedictory hypothesis entailing the celebration of cyclical anniversaries marking the end of much larger increments of time such as katuns and baktuns recorded on stone monuments often associated with E Group plazas (Aimers and Rice 2006:88-91; Chase and Chase 2017:60; Rice 2004:76-92).

While this is an intriguing proposal, Awe *et al*. (2017:419) point out several troubling issues with testing the valedictory hypothesis in the Belize Valley. One problem is that most stelae in this region bear no trace of carvings. Though these monuments may have been painted or stuccoed, this material, along with the information it may have once composed, is now lost to time. To make matters even more complicated, several E Group plazas in the Belize Valley have no monuments at all. As Awe and colleagues (2017:419) remark, these issues make testing this hypothesis extremely difficult.

There is, however, one obvious functional crossover between E Groups and the Belize Valley ETA—assemblages in both groups have been found with interments associated with ancestor veneration. Ritual deposits of human remains in the form of burials, caches, and offerings were placed into E Group architecture for the purpose of ancestor veneration starting as early as the Middle Preclassic period and would become more frequent during the Late Preclassic and Early Classic periods (Brown 2017:399). According to Patricia McAnany (1995:110), interring important lineage members into ancestor shrines was not only for commemoration purposes but was also a strategy for particular lineage members to secure rights to land and resources. This concept was expanded upon by the ruling elite who used ancestor veneration not only to claim rights to land and resources but also to legitimise ritual supremacy and dynastic rule (Brown 2017:387; Chase and Chase 1995:100). Placed within public ceremonial architecture like the E Group complex, the deceased would be deified, rendering the royal lineage divine by association, eternally binding them to communal traditions.

While the interments placed into E Groups and ETAs were likely similarly motivated, for whatever reason, the practice of ancestor veneration was far more intensive in the Belize Valley assemblages. The quantity of interments placed within ETAs greatly exceed those found within E Groups outside this region. In comparison with the burial numbers of ETAs presented in Table 5.1, well documented E Groups outside of the Belize Valley contain very few burials. The Cenote E Group was found with a total of two burials located within the central eastern building, both dating to around the onset of the Early Classic period (Chase 1983; Chase and Chase 2017:49). A total of four Early Classic period (AD 250-600) burials were found within the eastern buildings of Caracol's E Group (Chase and Chase 1995:97). At Uaxactun, only a single interment was located in the E Group's western structure, Structure E-VII, while several skull caches and the bones of a child were located within the eastern buildings (Ricketson and Ricketson 1937:49-58). Thus, the number of burials located in the ETA of the Belize Valley greatly outnumber those found in E Groups outside of this region.

Table 5.1. Number of burials and caches found within the four structures of the ETA (after Awe et al. 2017:433, Table 13.2).

Site Name	Total # of Burials/Caches	Central Str.	Northern Str.	Southern Str.	Western Str.
Pacbitun	**21 Bu. - 11 Ca.**	**10 Bu. - 9 Ca.**	**3 Bu. - 1 Ca.**	**2 Bu. - 1 Ca.**	**6 Bu.**
Cahal Pech	18 Bu. - 8 Ca.	12 Bu. - 6 Ca.	2 Bu.	4 Bu. - 2 Ca.	NDA
Baking Pot	5 Bu. - 4 Ca.	4 Bu. - 4 Ca.	NDA	NDA	1 Bu.
Chan	14 Bu. - 8 Ca.	8 Bu. - 5 Ca. *	1 Bu. - 3 Ca *	NDA	5 Bu.
Xunantunich	3 Bu. - 4 Ca.	NDA	NDA	3 Bu. - 3 Ca.	NDA
Blackman Eddy	4 Bu. - 1 Ca.	1 Ca. *	NDA *	4 Bu. *	NDA
El Pilar	NDA	NDA *	NDA	NDA	NDA

Key: NDA - No Data Available; Asterisk (*) - Looted

The Ceremonial Assemblage at Pacbitun

The archaeologically confirmed Preclassic domestic use of Plaza B (Hohmann 2002; Hohmann and Powis 1999) in addition to the range buildings that still frame its plaza space today suggest that this location was primarily used as Pacbitun's residential setting—a place that would have been reserved for the Classic period site core elite (see chapter three, this volume). Recent investigations of the three courts to the south of Plaza B and C argue for the palatial function of this space, an area clearly demarcated for Pacbitun's royalty and associated amenities (see chapter six, this volume). Like these two locales, excavations have determined that Plaza A also served a primary function as the site's ceremonial hub beginning with El Quemado in the Middle Preclassic period and then shifting to the E Group complex for the remainder of Pacbitun's occupation (see chapter three, this volume; Healy *et al*. 2004a; Micheletti *et al*. 2016; Micheletti *et al*. 2017; Powis *et al*. 2017). The architecture that composes the site's E Group arrangement frame the east and west edges of Plaza A. Structure 1 centres the eastern edge and is flanked by Structure 4 and Structure 5 to the north and south, respectively. Situated directly across the plaza, Structure 2 centres the western edge of Plaza A sharing the central axis with Structure 1. Aside from Structure 10, these four buildings are the most impressive monumental constructions at the site.

Each of these structures were extensively excavated during Pacbitun's initial archaeological investigation led by Paul Healy of Trent University in 1986 and 1987 (see chapter two, this volume; Healy 1990a:249). Although Healy's excavations penetrated the summits of all four buildings, only Structures 1, 2, and 4 would be trenched along their central axes. In an effort to complete the axial exploration of the assemblage's structures, Structure 5 was trenched in 2014 to gather additional architectural and functional data (Micheletti 2016). The following section will detail the construction and interment history of Pacbitun's assemblage, from its inception in the Preclassic to the site's abandonment around the Terminal Classic (see Table 1.1 for Pacbitun's chronology). Before starting however, there are a few particulars that should be noted. Because the focus of this chapter is to identify attributes associated with the E Group and ETA, the forthcoming architectural descriptions will not include specifics (i.e., style, number of stairs/terraces, courses of cut stone) unless directly related to the aforementioned archetypes. Descriptions will primarily focus on structure height, extent of construction, architectural features, and interments. Furthermore, while the number of caches placed into the E Group are known, the specifics of them are not. Therefore, they were excluded from this discussion.

A Ceremonial Precursor: The Mai Phase (900-300 BC)

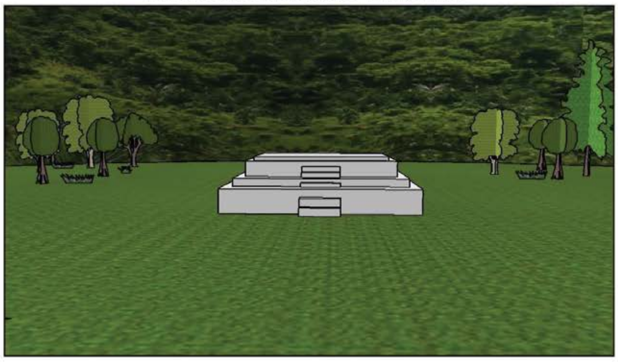
Unlike most E Group architecture, Pacbitun's E Group assemblage was not the first monumental construction built at the site. Pacbitun's success during the early Mai phase (900-600 BC) is evinced beneath Court 2 with the construction of a large round platform measuring 12 m in diameter (see chapter three, this volume). A heightened success, carried over into the late Mai phase (600-300 BC), can be seen with the construction of El Quemado, a large 2 m tall ceremonial platform found 50 cm beneath the northern end of Plaza A (see chapter three, this volume; Micheletti *et al*. 2016; Micheletti *et al*. 2017; Powis *et al.* 2017). To date, the construction of El Quemado signals the designation of Plaza A as Pacbitun's ceremonial space.

Initial Construction: Puc Phase (300-100 BC)

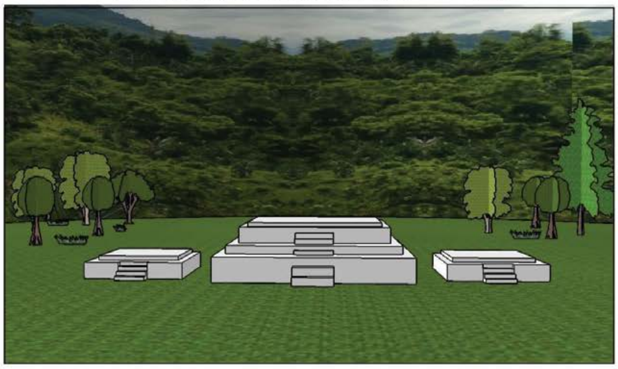
The sacredness of Plaza A is substantiated by a massive Late Preclassic period overhaul. Rather than renovating or removing El Quemado, the inhabitants of Pacbitun opted to bury the massive Middle Preclassic platform to make way for new ceremonial architecture to be built upon a renewed plaza surface (see chapter three, this volume). The first buildings to be constructed on the renovated surface of Plaza A, now 2.5 m higher, was a central eastern building, Structure 1, and a western plaza building, Structure 2 (Healy *et al.* 2004a:210). Interestingly, Healy's investigations of Structure 1 obtained a radiocarbon sample (520 BC ± 100, Beta-25378) that, if correct, would imply that Structure 1 had been constructed during the Middle Preclassic period suggesting contemporaneity with El Quemado (Healy *et al*. 2004a:209-210; Healy *et al*. 2004b:229). However, considering the Late Preclassic period build-up and the Puc phase (300-100 BC) plaster surface of Plaza A, it may be that this date is incorrect or associated with earlier, buried architecture. Nevertheless, more evidence is needed to confirm whether it had been constructed before or after the Late Preclassic plaza build-up.

Shortly after the construction of Structure 1 and Structure 2, two identical stepped platforms, designated as Structure 4 and Structure 5, were added to the eastern edge of the plaza, constructed to the north and to the south of Structure 1, respectively. Thus, by the end of the Late Preclassic Puc phase (300-100 BC), all four buildings that compose Pacbitun's ceremonial assemblage are present. The three eastern buildings, aligned north to south, sat separate from one another while Structure 1 and Structure 2 shared a central axis across plaza space (Figure 5.4).

Late Middle Preclassic-Mai phase



Late Preclassic-Puc phase (300-100 BC)



Terminal Preclassic-Ku phase (100 BC - AD 300)

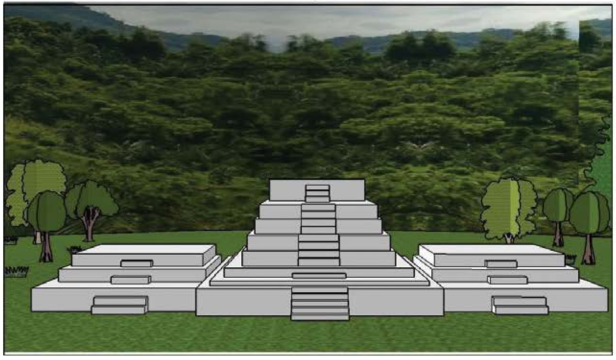


Figure 5.4. Hypothetical reconstruction model of the Eastern Triadic Structure at Pacbitun during the (top) Late Middle Preclassic, (middle) Late Preclassic, and (bottom) Terminal Preclassic periods (created by George J. Micheletti in Sketchup).

Construction Episode 2: Ku Phase (100 BC-AD 300)

The first renovation to the three eastern structures occurs during the Terminal Preclassic Ku phase (100 BC-AD 300). At this time, the architectural additions to Structure 1 cause it to partially overtake the flanking structures, essentially creating a single eastern range-like structure (Figure 5.4; Healy *et al*. 2004a:210). Placed on the central axis of the newly renovated Structure 1, Burial 1-5 is the earliest interment recovered from the assemblage (Healy 1990a:256). This Ku phase burial was a simple crypt which held the remains of an adult male positioned so that his head lay to the south (Robertson 2011:168, Appendix 1). The flanking structures are also modified at this time; their renovation seemingly uniform and simultaneous. Measuring from the Ku phase Plaza A plaster floor, Healy (1990a:256) suggests that the summit of Structure 1 now stands approximately 7 m high while the flanking structures are no taller than 3 m (Healy *et al*. 2004a:210; Micheletti 2016:53).

Construction Episode 3: Tzul Phase (AD 300-550)

The entire ceremonial assemblage is renewed again during the Early Classic Tzul phase (AD 300-550), including two major renovations to the unified eastern structures. Included in the modifications is a small 'masonry-and-timber' shrine centred on a stair near the base of Structure 1 (Figure 5.5; Healy 1990a:256). Interestingly, the shrine was placed directly over the Ku phase simple crypt, Burial 1-5 (Healy 1990a:256). Also associated with the Early

Early Classic Tzul Phase (AD 300-550)

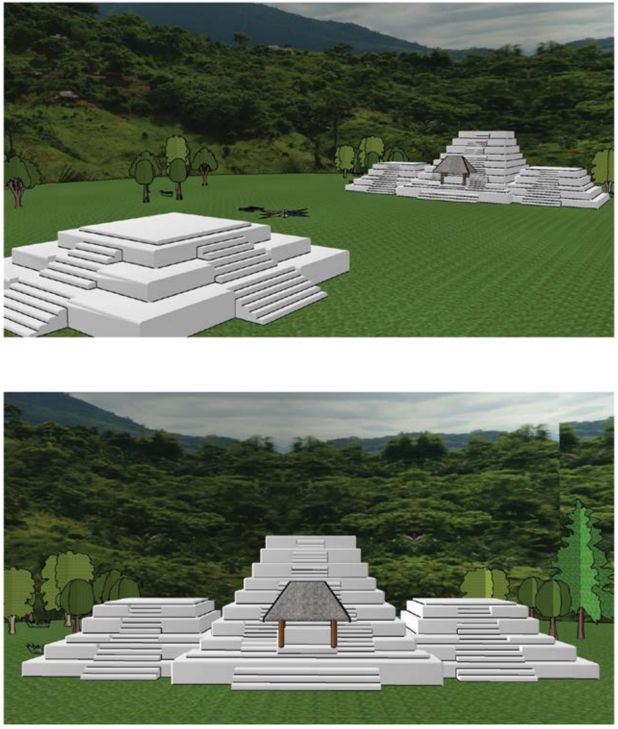


Figure 5.5. Hypothetical reconstruction model of the Early Classic Eastern Triadic Structure/Assemblage at Pacbitun (created by George J. Micheletti in Sketchup).

Classic Structure 1 modifications, the second burial (Burial 1-6) placed within this building is believed to be the earliest multiple burial interred at the site of Pacbitun (Robertson 2011:168, Appendix 1). Placed on the building's central axis, Burial 1-6 was an elaborate crypt containing the remains of a male placed in an extended position with head to the south and a female placed in a seated position (Robertson 2011:168, Appendix 1). Examining the two flanking structures, the first of the two enlargements raised the summit floor of each platform approximately 1.3 m (Paul F. Healy, personal communication, 2014; Micheletti 2016). The second Early Classic construction effort is minor in comparison with the first, raising the height of the summit floor of each platform an additional 30-40 cm.

Construction Episode 4: Coc Phase (AD 550-800)

Sometime during the early part of the Late Classic period, Pacbitun's entire ceremonial assemblage received elaborate modifications. Notably, the raised summit of Structure 2 would now support the assemblage's first vaulted masonry superstructure (Healy 1990:257). Even more interesting, two burials were also placed within Structure 2 during this time period.

Across the plaza, the renovations to Structure 1 would replace the small basal stair shrine with the construction of a stair block approximately halfway up the main staircase. The significance of this stair block is that it marks the location of a slate covered, corbel vaulted tomb constructed at the bottom of a 5 m deep shaft (Healy *et al*. 2004a; Healy *et al*. 2004b). Placed within this tomb, the remains of Burial 1-9 belong to an adult male, approximately 45 years old, placed in an extended, supine position with head to the south (Robertson 2011:168, Appendix 1). The elaborate nature of the tomb, opulent grave goods, and liberal use of red-ochre all indicate that this individual held regal status and most likely served as a ruler at Pacbitun during the Late Classic period (Healy *et al*. 2004b:231).

In addition to Burial 1-9, six more interments dating to the Late Classic were placed on the central axis of Structure 1. Laid within the newly constructed stair block, Burials 1-1 (partial cist) and Burial 1-2 (simple crypt) contained a female and male, respectively, both placed in an extended, supine position (Robertson 2011:168, Appendix 1). The remains of Burial 1-4 and Burial 1-8 were both females interred within elaborate crypts in an extended, supine position with their heads oriented to the south (Robertson 2011:168, Appendix 1). Burial 1-3 was composed of a male, female, and juvenile interred beneath Stela 1 at the base of the structure; the latter individual had been placed within a vessel while the male and female were extended and supine with heads to the south (Healy *et al*. 2004a; Healy *et al*. 2004b; Robertson 2011:168, Appendix 1). Finally, in front of (to the west of) Stela 1 at the base of Structure 1 were a pair of simple cists, Sub 1-1 and Sub 1-2, stacked one on top of the other. While nothing remained of the upper individual, the lower individual was determined to be a male who was situated in an extended, supine position with head to the south (Powis *et al*. 2019b:87-91).

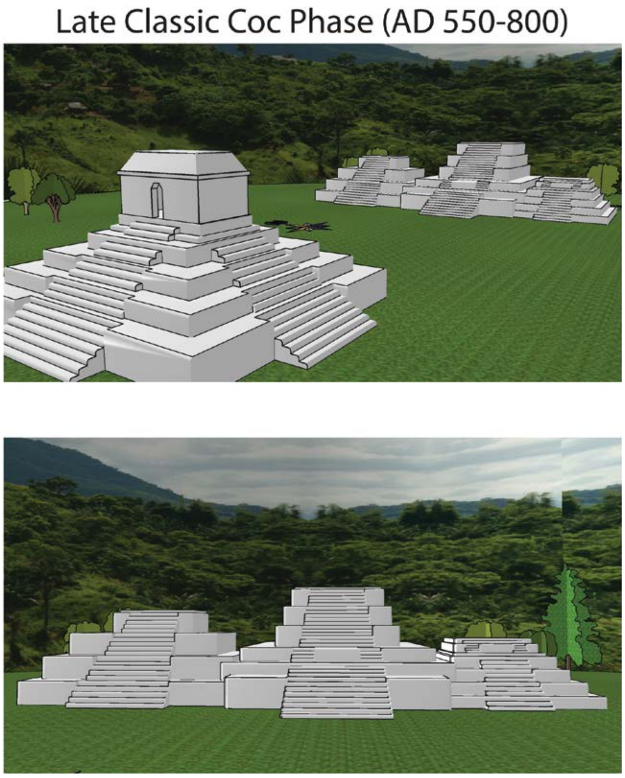


Figure 5.6. Hypothetical reconstruction model of the Late Classic Eastern Triadic Structure/Assemblage at Pacbitun (created by George J. Micheletti in Sketchup).

Unlike the previous construction episode, Structure 4 and Structure 5 would both receive individual architectural modification and would also receive their first centre-line interments during the Late Classic period (Figure 5.6). The summit of the southern building, Structure 5, was raised approximately 90-100 cm, now standing 5.3 m above the terminal Plaza A floor (Paul F. Healy, personal communication, 2014; Micheletti 2016:52). Placed directly beneath the new summit, Burial 5-1 was a simple crypt containing the remains of an extended, supine male individual with head to the south (Robertson 2011:168, Appendix 1).

Renovations to the northern building, Structure 4, were far more drastic than its southern counterpart, raising the platform's summit about 3.5 m, bringing the height of the building to around 8 m (Paul F. Healy, personal communication, 2014). Two burials were placed within the core of this newly constructed architecture. The female in Burial 4-1 (elaborate crypt) and the male, female pair in Burial 4-2 (simple crypt) were placed in an extended position with their heads oriented to the south (Robertson 2011:168, Appendix 1).

Construction Episode 5: Tzib Phase (AD 800-900)

As with the previous construction phases, all four of the structures in the ceremonial assemblage were renovated during the Terminal Classic Tzib phase (AD 800-900), though this episode would be their last. The summit of Structure 1 now stands 12.5 m above the terminal Plaza A floor. However, with the addition of a vaulted masonry superstructure, a feature that would now cap all four structures of the ceremonial assemblage, Structure 1 reached its peak height of 16.5 m (Healy *et al*. 2004a:210). The base of Structure 1 measures 17.8 m wide and was centred by a staircase approximately 11.6 m wide (Healy 1990a:251; Healy *et al*. 2004a:210).

After placing six burials during the previous Coc phase, the final phase of construction of Structure 1 would only include a single centre-line interment. Burial 1-7 contained the remains of a male and female placed into a cist/capped pit in an extended, supine position with their heads oriented to the south.

Replacing the old superstructure, the raised summit of Structure 2 received a new 4 m tall vaulted superstructure bringing the height of the terminal architecture to 11.2 m (Healy 1990a:252). Structure 2, measuring 25 m at its base, received its first stair block constructed on the upper portion of a 5.6 m wide central stair. Unlike the Structure 1 stair block however, no burials were associated with this construction. However, a total of four burials were placed beneath the summit on the building's central axis. Burial 2-1 and Burial 2-2 were both simple crypts containing the remains of a female and a male, respectively, placed in an extended position with head oriented to the south (Robertson 2011:168 Appendix 1). Capped by slate slabs, Burial 2-1 was placed beneath the summit of the structure and found with 27 vessels and an assortment of prestigious goods including numerous musical instruments (see chapter eight, this volume; Healy 2003:63; Healy *et al*. 2004a). Burial 2-5 and Burial 2-6 were urn burials each containing the remains of a juvenile and placed within the fill on the central axis of Structure 2 (Healy *et al*. 2004a:215).

Structures 4 and 5, in their final form, measured 16-18 m at their base. After climbing nearly 3.5 m after the previous Coc phase construction episode, the summit of Structure 4 would only be raised an additional 40 cm to bring the summit's height to 8.2 m. With the addition of the vaulted superstructure, Structure 4 stood 12.2 m in its final form. The summit of Structure 5, on the other hand, was raised 1.7 m bringing the height up to 6.9 m, or 10.9 m with the vaulted superstructure addition (Figure 5.7; Healy 1990a:252; Healy *et al*. 2004a:210). While no burials were placed within Structure 4 at this time, only a single poorly preserved simple pit interment, Burial 5-2, was placed beneath Stela 2 centred at the western base of Structure 5 (Paul F. Healy, personal communication, 2014). Neither sex, nor position/orientation could be identified for this individual.

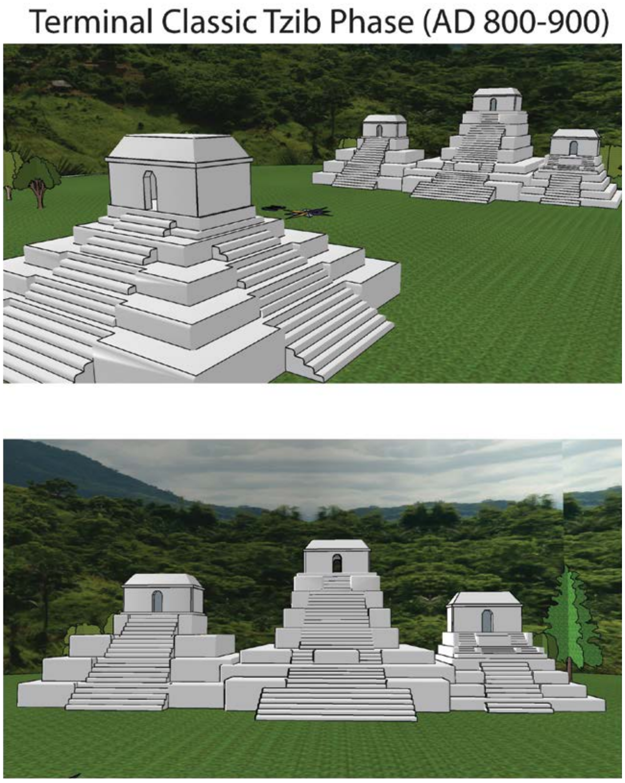


Figure 5.7. Hypothetical reconstruction model of the Terminal Classic Eastern Triadic Structure/Assemblage at Pacbitun (created by George J. Micheletti in Sketchup).

Discussion

After examining each of the architectural phases of construction for the buildings that compose Pacbitun's ceremonial assemblage, the following section will identify the assemblage's physical and functional attributes that apply to the E Group complex and the Belize Valley ETA. As the details presented in this section will demonstrate, while both E Group and ETA attributes appear to be present throughout the assemblage's existence, the most important attributes that define the ETA are not fully present until after the Late Classic construction event.

The Mai Phase (900-300 BC) Attributes

Taking into consideration the early radiocarbon date from Structure 1 of ca. 500 BC, it is certainly possible that an earlier version of this eastern building shared a plaza with El Quemado during the Middle Preclassic period. Considering the proximity in relation with El Quemado, the location of Structure 1 would fit nicely as the eastern structure in a much smaller and more compact Plaza A. However, any relationship between these two structures has yet to be confirmed spatially and remains unclear. Nevertheless, for the sake of this chapter, the most important detail to understand is that the earliest architectural evidence of the E Group/ETA at Pacbitun comes from Structure 1 and Structure 2.

The Puc Phase (300-100 BC) Attributes

Focusing on the eastern edge of the plaza, rather than the quintessential long, low eastern range platform associated with the E Group archetype, a single building, Structure 1, was constructed. While not much is known about this building's initial form, it would have been no longer (north-south) than the flanking structures yet to be built. Therefore, if the long, low eastern platform is one of the defining foundational attributes of the E Group complex, this construction certainly does not comply. On the other hand, as the central building of what will become an eastern triadic formation, Structure 1 appears to precisely follow the initial construction pattern of an ETA as defined by Awe and colleagues (2017) after their investigation in the Belize Valley. What is more, a single structure centrally positioned on the eastern edge of a plaza is also an attribute assigned to eastern shrines (Becker 1971, 1982, 2003, 2004). If the ideologies of the central buildings of the Belize Valley align with the eastern shrine archetype, this would certainly explain the shrine attributes discussed by Awe *et al*. (2017). However, no burials were recovered from the earliest version of Structure 1 to support this theory.

The final two buildings that composed Pacbitun's ceremonial assemblage, Structures 4 and 5, were added to the eastern edge of Plaza A during the Late Preclassic period. Completing the eastern formation, the three buildings all sat as separate entities at this time. Interestingly, the presence of a north-south aligned eastern plaza arrangement is an attribute of the E Group complex and the ETA. What differentiates the definition of these two archetypal attributes is the presence/absence of the eastern platform base. This platform served to support and symbolically unite the three eastern superstructures, each considered to represent one part of a single, multicomponent structure. Minus this platform, the eastern plaza structures at Pacbitun are only united by the plaza edge they each sit upon, and thus they are considered to be three separate entities that, together, compose an assemblage of architecture. Whether this physical technicality matters functionally is debatable, though that is an entirely separate argument. Regardless, the later addition of separate eastern flanking structures is a common theme for the Belize Valley assemblages identified by Awe and colleagues (2017). Adding to the ETA attributes, while Pacbitun's eastern flanking structures are constructed simultaneously, Structure 1 is not renovated or modified at this time. As previously mentioned, Awe *et al*. (2017:243) found that eastern structures were often modified individually and on separate occasions resulting in unique construction histories. There are, however, two attribute that do not conform to the ETA model. The first is that both flanking structures at Pacbitun appear to be twin constructions meaning that the eastern triadic arrangement would have been architecturally symmetrical—an E Group attribute likely associated with this archetype's early function as a solar observatory. The lack of symmetry in ETAs is thought to be a result of the independent modification to the three eastern structures. The second issue is that no burials from this period were recovered from any of Pacbitun's four structures, negating any shrine function to this point.

The Ku Phase (100 BC-AD 300) Attributes

As part of the Ku phase renovations, the eastern buildings in Plaza A are fused together as a result of the growth of Structure 1 to become a unified tripartite structure (Healy 1990a:251). Again, this is the exact architectural progression of the Belize Valley ETA as proposed by Awe and colleagues (2017). With these obvious ETA attributes, it would seem that the placement of the first burial, Burial 1-5, into Structure 1 at this time further supports the ETA archetype at Pacbitun. However, as mentioned above, the E Group complex was also associated with interring elite individuals, the practice beginning during the Terminal Preclassic period and continuing into the Early Classic period. Making this determination even more difficult is the fact that this construction episode renovated each of the three eastern structures simultaneously. Moreover, the flanking buildings are again modified uniformly so that the eastern triad, now a single structure, remained symmetrical. These are both attributes of the E Group complex which conflict with the attributes of the ETA.

The Tzul Phase (AD 300-550) Attributes

The two renovations of the Early Classic period are composed of the same attributes as the Ku phase modifications. All three eastern structures receive renovations that are once again uniform so that the eastern structure retained its symmetrical aesthetic. Up to this point, this E Group attribute has been consistent throughout each of the construction events. Evidence of shrine activity continues but seems to be confined to Structure 1 with the construction of the small shrine overtop of the Ku phase interment and the placement of Burial 1-6. The addition of this burial brings the ceremonial assemblage's interment total to two. According to Welsh (1988:190-192), along with the shrine feature of Burial 1-5, the treatment (i.e., position, orientation), prestigious grave goods, elaborate grave construction, and centre-line location of Burial 1-6 identify this burial as a high-status interment and clearly demonstrates a shrine function for the purpose of ancestor veneration. Again, placing ancestral remains within E Group architecture is not an unusual practice in the southern Maya lowlands from the Late Preclassic to the Early Classic period (Chase and Chase 1995:100). Therefore, the placement of two burials within Structure 1 neither confirms nor denies Pacbitun's assemblage as E Group or ETA. While the absence of burials in Structures 4 and 5 should not be overlooked, it is difficult to exclude them from the shrine function since the three buildings now form a single eastern structure. Clearly, to this point, Pacbitun's assemblage contains an amalgam of attributes belonging to the E Group complex and ETA. Yet, despite the absence of the low eastern platform and the process through which the eastern structures become a single entity, both representing attributes associated with the Belize Valley ETAs, the attributes that are most represented up to and including the Early Classic renovations belong to the E Group complex. After the following construction event of the Late Classic period, however, this would no longer be the case.

The Coc Phase (AD 550-800) Attributes

As the previous sections have discussed, all construction episodes of Pacbitun's three eastern structures have been uniform and, apart from the addition of the flanking structures, share the same construction history. This holds especially true for Structures 4 and 5, the eastern flanking structures, as they appear to receive identical modifications. After the Late Classic Coc phase construction event, the renovations to the two structures were drastically different. It is at this time that these simple platforms were transformed 'into more elaborate temple-pyramids, with more distinct identities' (Healy 1990a:252). Although both modifications were extensive, those to Structure 4 were far greater—its summit climbing 2.5 m above Structure 5 at this time (Paul F. Healy, personal communication, 2014). While there is no indication to suggest that they were modified at different time, it is clear that Structure 4 now has a sizable height advantage over Structure 5, destroying the carefully constructed symmetry of the previous phases. As Figure 5.7 demonstrates, the assemblage's non-symmetrical appearance looks less like an E Group and more like the ETAs of the Belize Valley region (Awe *et al.* 2017).

The distinct architectural modifications to the eastern assemblage would not be the only ETA attribute to present itself during this Late Classic construction event. The placement of eleven burials within the four structures that compose Pacbitun's assemblage implies that its shrine function had intensified dramatically. Before the event, four major renovations occurring between the Late Preclassic and Early Classic periods are associated with a total of two burials placed into a single eastern structure, Structure 1. Now associated with all four structure, the eleven burials dating to the Late Classic Coc phase (AD 550-800), whether interred all at once or intermittently throughout the time period, had been placed in about a third of the time and count for half of the ceremonial assemblage's entire burial collection. Together, the numerous interments and unique renovations seemingly suggest that the assemblage's shrine function is its most important function.

Additional evidence of an exaggerated shrine function for Pacbitun's assemblage can also be found by examining burial characteristics. Healy *et al.* (2004a:215) states that 'there was a striking degree of uniformity in burial practices in the Core Zone' with almost all interments 'found in an extended position, mostly supine, with legs crossed and heads oriented to the south.' Most interments were also found on their respective structure's central axis (Healy *et al.* 2004b:229). It should also be noted that, when compared with all other burials found at Pacbitun, the Late Classic burials were placed into more elaborate graves, found with better furnishings, and even appeared to follow more stringent burial regulations, all evidence to support an intensified ancestor shrine function (Robertson 2011:103-115; Welsh 1988:186). In the case of the sub-stela burial of Burial 1-3 and the cist burials placed to the west of this stela (Sub 1-1 and Sub 1-2), the individuals placed here are not considered to be elite interments but are actually thought to be sacrificial victims (Healy *et al.* 2004a:215). Welsh (1988:169-170) considers interments beneath and in front of stela to be dedicatory cache burials placed in honor of the erection of the stela. The meaning of these and other sacrificial methods of interment will be further discussed in the following Tzib phase section.

Architecturally, the vaulted masonry superstructure constructed at the summit of Structure 2 is built over the top of the first two burials placed into the western building. Interestingly, superstructures are not typically features of western E Group structures (Aimers and Rice 2006:79; Cohodas 1980:209). Additionally, although the small shrine centred on the basal step of Structure 1 is removed, the stair block that was constructed at this time is also thought to serve as a shrine feature (McAnany 1998:280; Welsh 1988:190-191). Like the Structure 2 superstructure, the stair block had also been built over significant high-status burials—Burial 1-9 being the most elaborate burial found to date at Pacbitun—and even contained Burial 1-1 and Burial 1-2. Features like the stair block and the vaulted superstructure were constructed to commemorate those interred beneath and would have been important locations for ritual practices associated with ancestor veneration.

The unique constructions of the Late Classic construction event and the interment of multiple elite individuals associated with the architecture of this renovation clearly identifies Pacbitun's ceremonial assemblage as an ETA (Awe *et al.* 2017). As a result of the loss of symmetry and intensified shrine activity, the assemblage seems to have acquired two of the most essential attributes associated with the ETA, helping to fully tip the scale toward the Belize Valley variant. After the final construction phase of the Terminal Classic Tzib phase, these ETA attributes appear to remain consistent. However, after the modifications and the interments of this phase, the ETA attributes are not as definitive when compared with the previous Coc phase attributes.

The Tzib Phase (AD 800-900) Attributes

Looking at the final construction event during the Terminal Classic Tzib phase (AD 800-900), the renovations made to Pacbitun's ceremonial assemblage were once again non-uniform, though they are thought to occur at the same time. Nevertheless, the assemblage continues to be non-symmetrical. However, the renovations made to Structure 5 greatly reduced the height differential between itself and Structure 4, now only 1.3 m taller than its southern counterpart.

Of the six burials associated with the Tzib phase, only three are considered to be high-status (Bu. 1-7, Bu. 2-1, and Bu. 2-2) while the other three are thought to be sacrificial victims (Bu. 5-2, Bu. 2-5, Bu. 2-6). All three of the sacrificial burials are thought to be dedicatory caches. The two urn burials (Bu. 2-5 and Bu. 2-6) were suggested to be part of 'dedicatory ceremonies associated with architectural renewal,' and Burial 5-2, like Burial 1-3, is considered to be a sub-stela cache dedicated to the erection of Stela 2 in front of Structure 5 (Healy *et al*. 2004a:215). Welsh (1988:65, 170) suggests that urn burials are similar to sub-stela burials in that they are both associated with caching locations and therefore should be considered 'dedicatory cache burials.'

Like the vaulted masonry building of Structure 2, the superstructures constructed on the summits of Structure 4 and Structure 5 may have been placed to commemorate the previous interments placed beneath the summit during the Coc phase; though, this is difficult to say with any certainty. While the stair block added to Structure 2 at this time may have served a similar purpose as the Late Classic period Structure 1 stair block, the feature was not covering a deep shaft but was actually constructed directly atop the previous architecture. The two stair blocks also differed in that there were no burials placed within the Structure 2 feature (Healy 1990a:252). Whether or not this stair block marked the location of an interment belonging to a previous phase is unknown as the architecture beneath this feature was not excavated.

On the other hand, the newly constructed summit and replacement superstructure atop Structure 2 was accompanied by two Terminal Classic burials (BU. 2-1, 2-2), both placed on the centre axis of the building. Although the grave construction for these interments was significantly less elaborate than their Coc phase predecessors, the grave goods associated with these individuals support their high-status. Therefore, these shrine attributes indicate a continued shrine function, at least for Structure 2.

Like the flanking eastern structures, Structure 1 was also topped by its first vaulted masonry superstructure as part of the Terminal Classic construction event. Again, this may have served to commemorate early burials placed beneath the summit of this structure. Interestingly, because no new interments were placed into Structure 4 and the burial associated with Structure 5 was sacrificial in nature, Structure 1 would be the only eastern building to receive an elite interment (Bu. 1-7) during the Tzib phase.

Looking at the Terminal Classic construction event as a whole, it appears that Pacbitun's ceremonial assemblage continues to function as an ETA. Despite the reduction in the height differential between Structure 4 and 5, the assemblage continues to be non-symmetrical. Furthermore, the placement of six interments suggests that the shrine function is continuing even though three of these are thought to be sacrificial victims placed to dedicate the erection of Stela 2 and the newly constructed architecture of Structure 2. The purpose of the stela erected in the Coc and Tzib phases is unknown due to the fact that all were plain. As previously mentioned, E Group stela often record important cycle ending dates; yet, stelae associated with this archetype as well as other public buildings were also known to document historic events and/or depict a specific ruler's ancestral connections (McAnany 1995:39-49). Even if these stelae did record cyclical dates, it does not detract from the assemblage's shrine function. Chase and Chase (2013:20) have found that shrine interments at Caracol may also be associated with cycles of time and suggest that ritual events involving burials and caches be 'interpreted within a broader cosmological frame that commemorates temporal cycles. Ritual timing may differ from lifespan timing. Thus, a burial may commemorate a larger event or cycle and not the simple death of an individual.'

Summary

After the chronological examination of the attributes of Pacbitun's ceremonial assemblage, there are several statements that can now be said with confidence. In the author's opinion, what truly defines Pacbitun's assemblage as an ETA and differentiates the E Group archetype from the Belize Valley assemblages is the initial construction sequence. Beginning with the central eastern structure and the subsequent addition of the flanking structures, the trio of separate eastern buildings is unique to the Belize Valley and likely represents this region's culturally motivated rendition of the E Group complex. The fact that the initial construction of the Belize Valley assemblages coincided with the appearance and mass production of hundreds of other E Groups in the Southern Maya Lowlands further supports these assemblages as regional variations on the E Group theme (Freidel *et al*. 2017). According to Chase and Chase (2017), the mass construction of the E Group complex works as a timestamp which physically signals the unification of Maya society. However, this does not mean that societies of the centres constructing E Groups already had or suddenly adopted all the same cultural mannerisms. While the overarching ideology of the E Group archetype was most likely homogeneous, the communities who constructed them were not. Therefore, culturally derived variations of the E Group form and function are inevitable. With that said, despite the lack of interments, the most important statement that can be made about Pacbitun up to the Puc phase construction episode is that their regionally shared ritual practice suggests a close relationship with sites of the Belize Valley during the Late Preclassic period (see chapter nine, this volume).

After the following Ku phase construction episode, the fusion of the three eastern structures in Plaza A continues to follow the Belize Valley construction sequence. However, the uniform and simultaneous modifications that would result in the architectural symmetry of Pacbitun's assemblage should not be ignored. Although Pacbitun's assemblage may forever be branded an E Group variant due to its unique architectural development, the physical and functional attributes that are associated with the ETA are absent or not fully developed during the Ku phase and two Tzul phase construction episodes. Furthermore, with only two interments at this time, the assemblage's Early Classic attributes are more reminiscent of the E Group archetype. After the Late Classic construction event, however, Pacbitun's assemblage has fully adopted the ETA attributes. The assemblage's loss of symmetry as well as the quantity, quality, status, and placement sequence of interments, some of which were associated with shrine related features, are all indicative of a shrine function. Regardless of whether or not the assemblage actually functioned as an E Group prior to this construction event, there is no doubt that this event alters the previous construction pattern and intensifies the shrine function. Ultimately, the data presented in this chapter indicates that Pacbitun's ceremonial assemblage was installed and initially developed as an ETA but would not fully function as this archetype, as defined by Awe *et al*. (2017), until after the Late Classic construction event.

Acknowledgements

Much of the data in this chapter was gathered as part of my MA thesis at the University of Central Florida. Therefore, I would first like to thank the Department of Anthropology at UCF and my thesis committee members, Dr. Sarah Barber, Dr. Diane Chase, and Dr. Terry Powis, as well as my thesis advisor and committee chair, Dr. Arlen Chase. Thank you all for providing me with the knowledge, skills, and encouragement without which this chapter would not have been possible. A special thanks to Dr. Paul Healy and Dr. Jaime Awe for sharing their own research data, allowing me to complete my thesis and this chapter. I would also like to express my gratitude to Dr. John Morris and the Institute of Archaeology in Belize for permitting Dr. Powis and PRAP to conduct research at the site of Pacbitun. Additionally, my appreciation also extends to the Alphawood Foundation for funding PRAP research. I would like to acknowledge all project staff and students for their assistance and recognize all the local workmen (and women) and the amazing people of San Antonio Village for their continued support. I would also like to thank my family and friends for standing by me and making me who I am today. To my wife Cassie, thank you for your love and patience. Last, but most certainly not least, there are two additional loved ones I wish to thank in particular—one of which had not yet arrived in this world for me to thank in my thesis acknowledgements and the other who is no longer in this world to see his acknowledgement in this chapter. To my daughter Ava, and my Dad, thank you both for giving me purpose.

6

Palace Courts at the Ancient Maya Site of Pacbitun, Belize

Sheldon Skaggs, Michael Lawrence, Karen Pierce, and Peter Cherico

Monumental architecture in the core of Maya sites was initially viewed in terms of two categories: temple-pyramids and palaces. Structures within the 'palace' group were a lumping of a variety of masonry structures, the main characteristic being that they were not temples (Webster 1998:24-25; Webster and Inomata 2008:151). The concept of 'palace' has evolved over time to generally mean site core masonry structures on low platforms with multiple small rooms or cells, potentially multi-storeyed, and usually arranged around restricted courtyards. Analysis of these structures reveals the buildings have functional attributes that were both public and residential, religious and political, thus making it difficult to assign the term 'palace' based on formal or functional attributes alone (Christie 2003a:2-6; Kurjack 2003; Webster 1998:24). Some would add to this a more detailed definition to the residential function in that the 'palace' group is inhabited by the royal family and possibly attendants or officials necessary for the needs of the family. In this chapter the authors will examine the area previously designated the 'Palace' group to determine if the archaeology matches the definition, along with what can be determined about the function of the group.

Background

Located off the south end of Plaza B, the 'Palace' group of Pacbitun's epicentre has been the subject of two excavation campaigns, first by Cassandra Bill in 1987 (see chapter two, this volume), and then more recently as part of the Pacbitun Regional Archaeological Project (PRAP) starting in 2016. The courtyards are made up of 13 range structures surrounding three restricted courtyards, labelled Court 1 to the east, Court 2 in the centre, and Court 3 to the west. In total, the two campaigns have focused on the centres of all three restricted courtyards (Cherico and Skaggs 2018; Pierce and Skaggs 2019) and five structures; Structure 23 on the north side of Court 2 (Bill 1987; Healy 1990a; Healy *et al.* 1995; Healy *et al.* 2007; Lawrence and Pierce 2018), Structure 25 on the east side of Court 1 (Skaggs *et al.* 2017a), Structures 22 and 33 on the north side of Court 3 (Pierce and Skaggs 2018), and Structure 29 on the east side of Court 3 (Figure 6.1; Skaggs 2019).

LiDAR data, obtained through funding provided by the Alphawood Foundation to the West-Central Belize LiDAR Survey, shows the relative elevation and height of structures above the courtyards in each group (Figure 6.2; Chase *et al.* 2014). Court 1 has the highest elevation at 229 m above sea level. This restricted area's ground surface is roughly 0.5 m higher than Plaza B and Court 2 ground surfaces. The restricted area measures 18 m east to west by 10 m north to south, which is about the same size as Court 2. The top of the mounds on all sides of Court 1 stand only 1.5-2 m higher than the current plaza surface.

Court 2 has a plaza area that measures 14 m east to west by 12 m north to south, and a ground surface elevation which is the same as Plaza B at 228.5 m above sea level. The surrounding mounds are about 1.5 m higher than the ground surface.

Court 3 has the largest restricted area, measuring 17 m east to west by 26 m north to south. It is also one of the lowest ground surfaces in the site core at only 224 m above sea level. The mounds on all sides are about 6-7 m above the courtyard ground surface, and tall enough to potentially be two-storey structures.

On the northern end of Court 3, the mound has a smaller, elevated group with two narrow buildings on its summit running from east to west, of which the walls on the outer sides of the mound were eroded. This building group on the northern mound appears to have an interior courtyard, surrounded by Structures 7, 22, 32, and 33. This courtyard within a courtyard is an unusual arrangement, similar to some elite courtyards on top of structures such as in the Northwest Acropolis at Caracol (Arlen Chase, personal communication, 2018; Chase and Chase 2006b) or the Central Acropolis at Tikal (Harrison and Andrews 2004), though built on a much smaller scale. This small courtyard is at an elevation of 230 m above sea level and measures 4 m north to south by 17 m east to west.

Excavations

Structures 22 and 33

Preliminary excavations, an approximate 1 m x 10.4 m unit extending in a north to south line across the centre area of Structures 22 and 33 in 2017 (Pierce and Skaggs 2018), revealed that the walls on the southern edge of Structure 22 and the northern edge of Structure 33 had collapsed down the steep slopes on both sides of the mounds. The buildings were likely wider in the past but are still clearly oriented along an east to west direction and enclose a flat courtyard-like area between them. Given the small size of this plaster floor area, it is not entirely clear whether it is a courtyard, or just an interior feature of a larger building consisting of only a single row of rooms on both the north and south sides. Current evidence suggests it was an open-air courtyard area, since no roof supports or collapsed

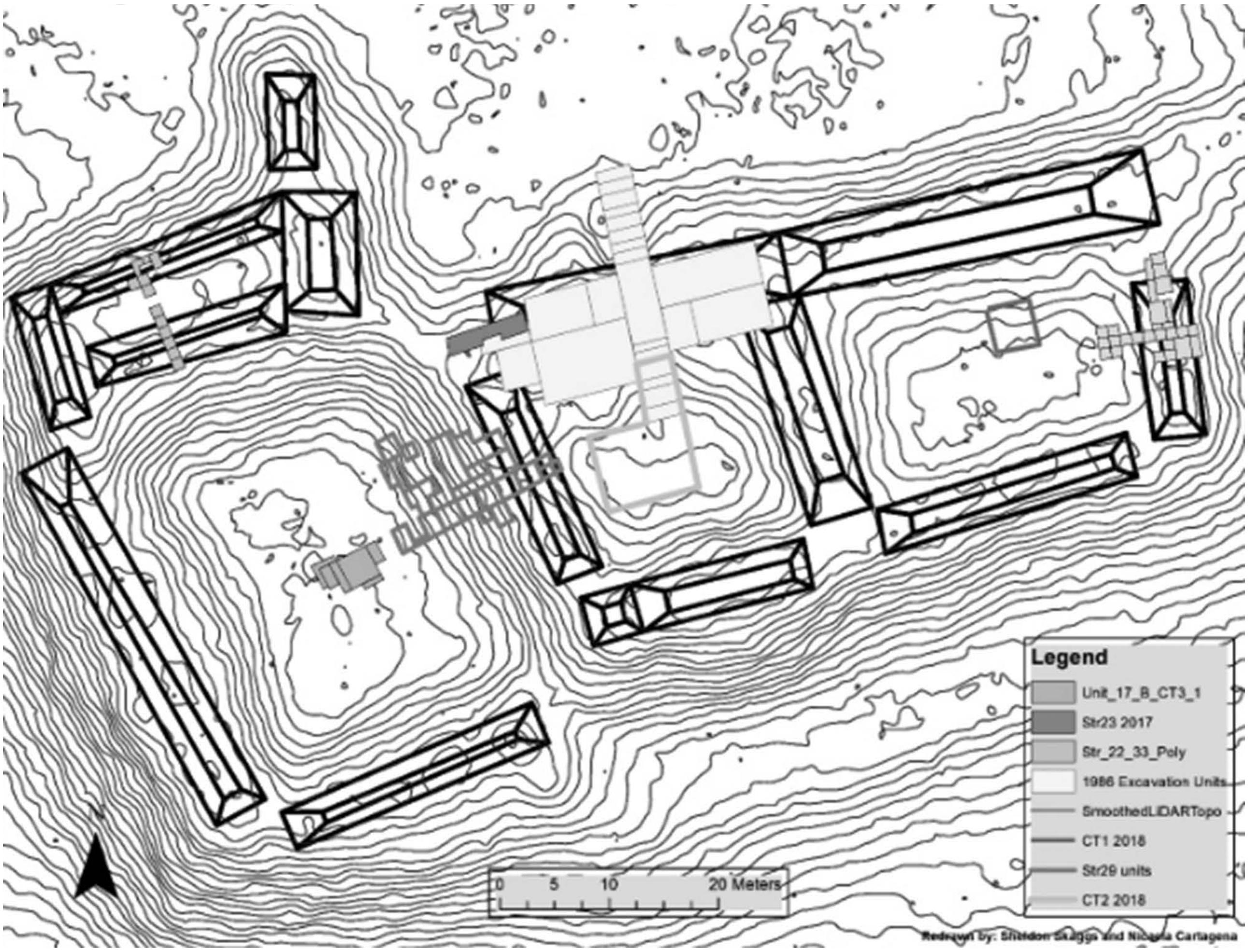


Figure 6.1. Map of Pacbitun Plaza B and courtyards of site core showing excavations that have been conducted in courtyards (from Skaggs and Powis 2019).

roof material was found across the plaster floor. A small courtyard similar to this is also found in the northwest acropolis at Caracol (Chase and Chase 2006b).

Court 1

In Court 1, under the north end of Structure 25 and presumably under Structure 24, evidence of a late Middle Preclassic midden was found. Just above the midden on the north end, a fill layer was found which also produced a ceramic dish base with a carbonised residue inside. The residue was radiocarbon dated to between AD 550-650 (Skaggs *et al*. 2017b). In units centred in front of Structure 25, charcoal was found just above bedrock which was radiocarbon dated to AD 640-675 (Skaggs *et al*. 2017a). In these central units, the first plaster floor sits on top of dry-laid boulder core fill. Limestone boulders ranging from 0.6 to 1.5 m in diameter were stacked nearly 2 m high before

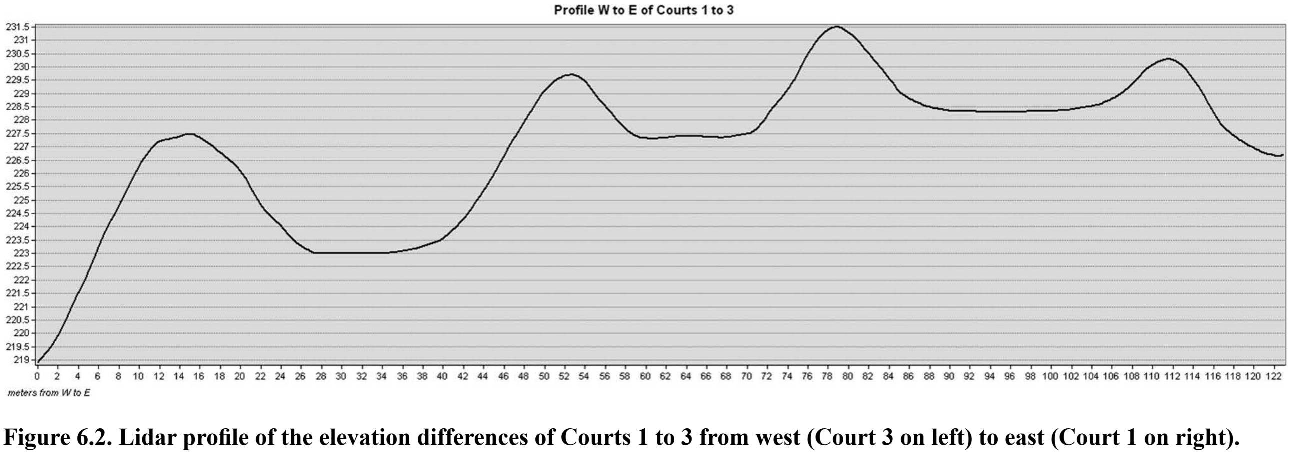


Figure 6.2. Lidar profile of the elevation differences of Courts 1 to 3 from west (Court 3 on left) to east (Court 1 on right).

ballast and plaster was laid down on top. Structure 25 was built on top of this floor. In this boulder core, a north to south aligned face of crude cut stones and a similarly crude east to west aligned face to the north, though not fully excavated, suggests there may have been an earlier platform built directly on bedrock and later covered by the boulder core fill (Figure 6.3; Skaggs *et al*. 2017a). There is evidence in the other excavation units of multiple additions to the original floor plan of the building, with rooms seemingly being blocked off or divided into smaller areas.

Based on excavation of the terminal architecture floor plan (Figure 6.3), there are three central steps or terraces ascending to the east and leading into a doorway at the centre of Structure 25. The space within the doorway opens to the south (and possibly to the north) into a space that is only 1.5 m wide east to west and 2 m wide to the south, ending in a shallow (10 cm tall) platform which fills half the southern end of the room. The floor plan is not symmetrical around the doorway and central stairs. Additionally, there is also a spine wall running north to south along the excavated portion of Structure 25.

Excavations following the spine wall to the north lead to the discovery of a new Altar 3 fragment (Figure 6.4; see Figure 2.4, this volume), recognised due to its yellowish limestone hue and the presence of a broad quatrefoil frame—distinct characteristics of the initial altar fragment found cached within Structure 1 (see chapters two and nine, this volume; Skaggs *et al*. 2017b). This fragment may have been recycled as building material, its distinct colouration setting it apart from the other facing stones. Measuring ca. 12.6 cm wide, 17.2 cm high, and ca. 20 cm thick, the fragment had been used as a facing stone within the basal course of the central spine wall. It was found upright, placed on one of its broken edges, and integrated into the western face of the spine wall of the northwestern room of Structure. 25. The fragment is the northernmost stone in the spine wall alignment, its placement abutting the room's northern wall, which runs perpendicular. The fragment appears to block what may have previously been a walkway between Structures 24 and 25. Its carved side faced east into the masonry, and its plain, albeit red-stained, underside faced west into the room.

The construction phase which incorporates the altar fragment was built upon a plaster floor that lips up to the south and may have been an entrance to Structure 25. The plaster floor was found to continue under the northern wall, indicating that it was a partition wall added subsequently. A dense ceramic cluster, designated Ceramic Scatter 1, was found atop this plaster floor, directly in front of the spine wall incorporating the monument fragment. This feature consisted predominantly of Late-to-Terminal Classic period sherds, including those assigned to Mount Maloney, Dolphin Head, Cayo, and Belize Groups (Gifford 1976). Below the plaster floor was another ceramic scatter, Ceramic Scatter 2, made up of similar ceramics. Excavations below the scatters reached a depth of about

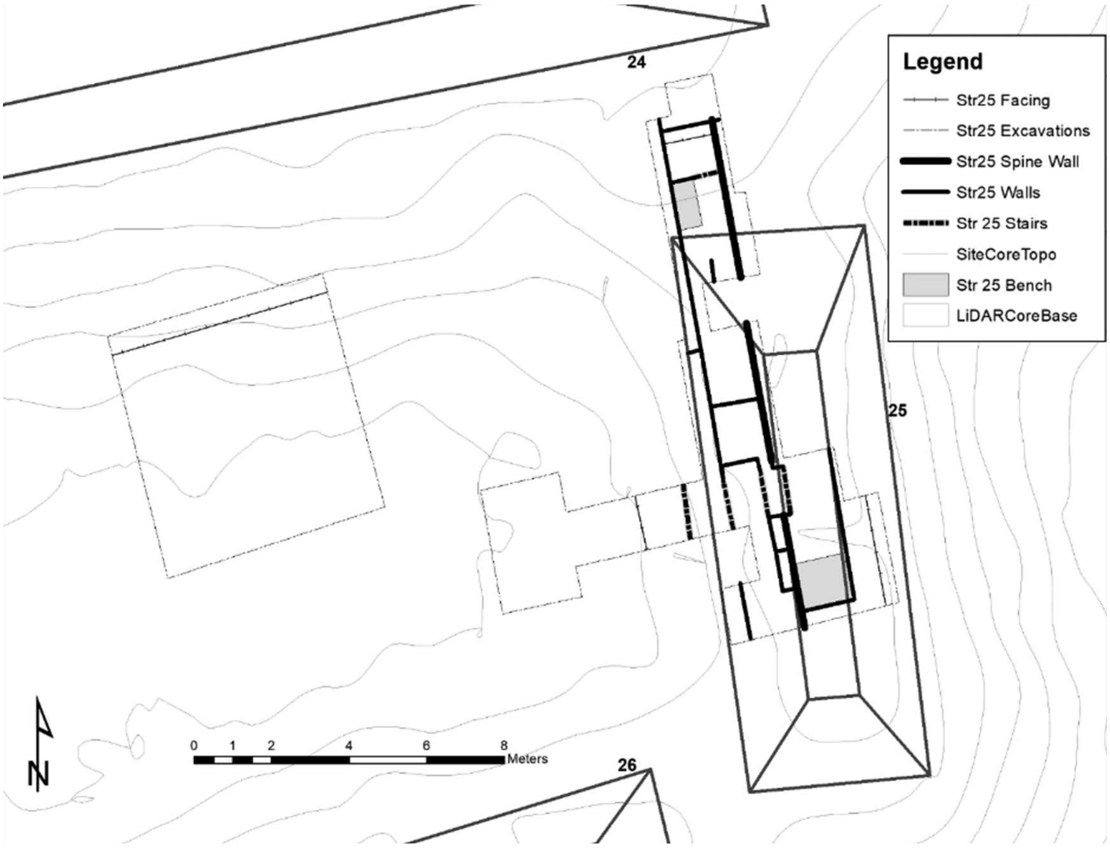


Figure 6.3. Plan map of the stairs, faces, and rooms found during the excavations of Structure 25 and courtyard of Court 1.

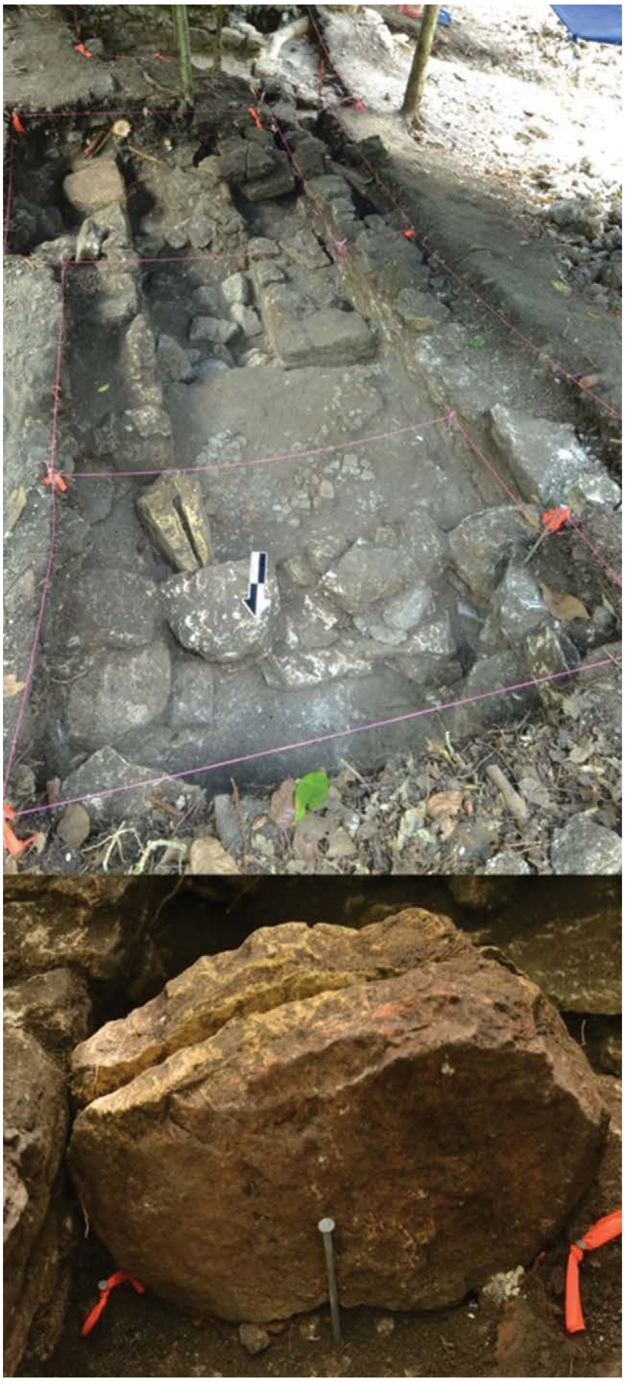


Figure 6.4. Location of Altar 3 fragment found in Structure 25 excavations. (top) Photo looking south showing yellow Altar 3 fragment blocking access between Structure 24 and 25. (bottom) Closeup of uncarved side of Altar 3 in situ.

3.2 m below this floor. There were a series of architectural features including a bench and two superimposed floors above the boulder core.

Numerous burned plaster fragments and patchy floor surfaces were found inside the building. However, no area was identified as a hearth, so it is impossible to determine if the burning was from a fire that consumed the building, cooking, or ritual uses of fire. At least a dozen mano or metate fragments were scattered among the excavation units, along with over a dozen obsidian blade fragments. These finds clearly indicate some domestic use of the building needs to be considered.

Court 2

Initial excavation in 2017 of a 3 m square unit in the centre of Court 2 revealed a 0.55 m, six course high wall (Cherico and Skaggs 2018). Further excavations in 2018 showed the wall to be a 12 m diameter Middle Preclassic round platform (Figure 6.5) with a tamped marl surface (see chapter three, this volume). The platform was subsequently covered by a midden-like layer containing *jute*, animal bones, ceramics, and a few pieces of worked jade. Preliminary ceramic analysis suggests the midden is contemporaneous with the event that the buried the Middle Preclassic community in Plaza B at the start of the Late Preclassic period. Above this midden were two plaster floors, one ceramically dated to the Late Preclassic or Terminal Preclassic period and the other to the Late Classic period (Cherico and Skaggs 2018).

Bill (1987) trenched into and under Structure 23, the excavation stretching from the courtyard of Court 2 to the plaza floor of Plaza B, where she encountered an edge of the Middle Preclassic round structure. However, in her operations the wall ran directly north to south, and the facing was east in Court 2. She noted similar walls with facing to the west under Structure 23 and in Plaza B. The west facing walls under Structure 23 and Plaza B suggest there may be additional buried structures covering a much larger area than the earliest structures identified in Plaza B (see chapter three, this volume). A radiocarbon date from a lot next to the wall returned a date of AD 90 ±130 years

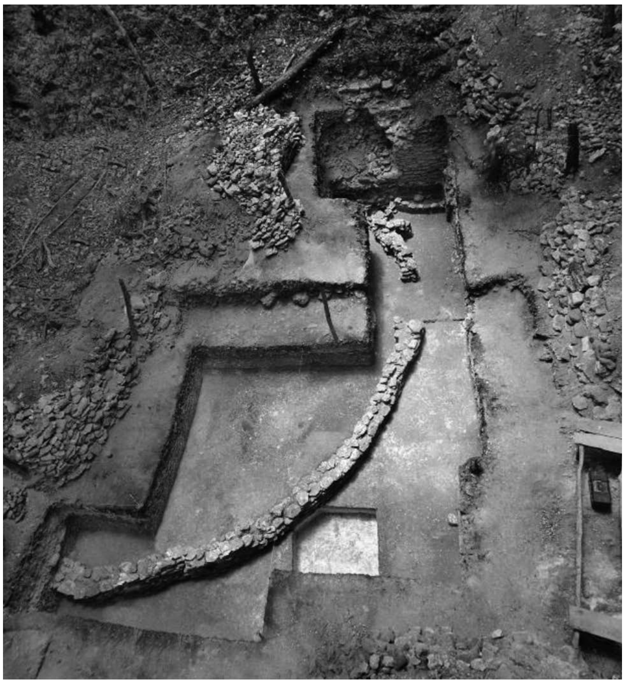


Figure 6.5. Looking north at location of the Middle Preclassic round structure and walls under Structure 23, Structure 29, and courtyard of Court 2. Photograph courtesy of Jeffery A. Powis.

(Bill 1987:123-128), suggesting the burial of the round platform and other possible buildings below the plaster floor occurred before the Terminal Preclassic period, Ku Phase (100 BC-AD 300). Clearly, the buried structures beneath Court 2 demonstrate a much earlier use of this space. These unique structures, particularly the round platform, are far more elaborate than the early buildings beneath the north end of Plaza B implicating contrasting functions and/or social status (see chapter three, this volume).

The initial occupation of what is now labelled Structure 23 appears to originate on the first plaster floor. Bill (1987) noted a number of additional construction phases after the first platform that ceramically date to the Early Classic period. In the Late Classic period, there may have been only a single thatch-roofed structure with low red painted walls and stairs down to the courtyard in Court 2. This room was then renovated and subdivided with transverse walls throughout the Late Classic period. Bill noted that the last major construction effort was to fill the earlier rooms and change the building in the Late Classic-to-Terminal Classic period with the addition of an east to west running spine wall (Figure 6.6). This separated the building from one that was facing south into the courtyard into one that faced both Plaza B and Court 2. The building had terraces and stairs on both north and south sides, with two unequally sized western and eastern rooms on both sides of the spine wall. The western rooms were longer than the eastern one with the northwest room including two benches. Later, in further modifications, the eastern rooms were both split into smaller spaces by transverse walls. The western room, facing out towards Plaza B was created from this splitting and included an eastern facing bench. This room was filled and plastered to create a room filling bench in a final renovation. Based on the collapse debris in the rooms, Bill (1987) considered it very unlikely that the structure was ever vaulted and suggested that a pole and thatch roof with no front walls on either north or south sides was the final configuration of the structure.

An extension, which Bill referred to as Structure 23 Annex, was added to the west of Structure 23 in the same construction phase as the addition of the spine wall, and would have completely blocked access between the western side of Court 2 and eastern side of Court 3 from Plaza B. This extension contained a bench and floor on which more than 30 slate slabs were stacked, as if from working or storage (Bill 1987; Healy *et al*. 1995; Lawrence and Pierce 2018). A number of whole pottery vessels were discovered between the eastern edge of this extension and the western edge of Structure 23. The restriction and blocking of access between corners of the court buildings was also discovered on the eastern side of Court 2 (between Structure 23 and 27) and as previously noted in Court 1 (between Structure 24

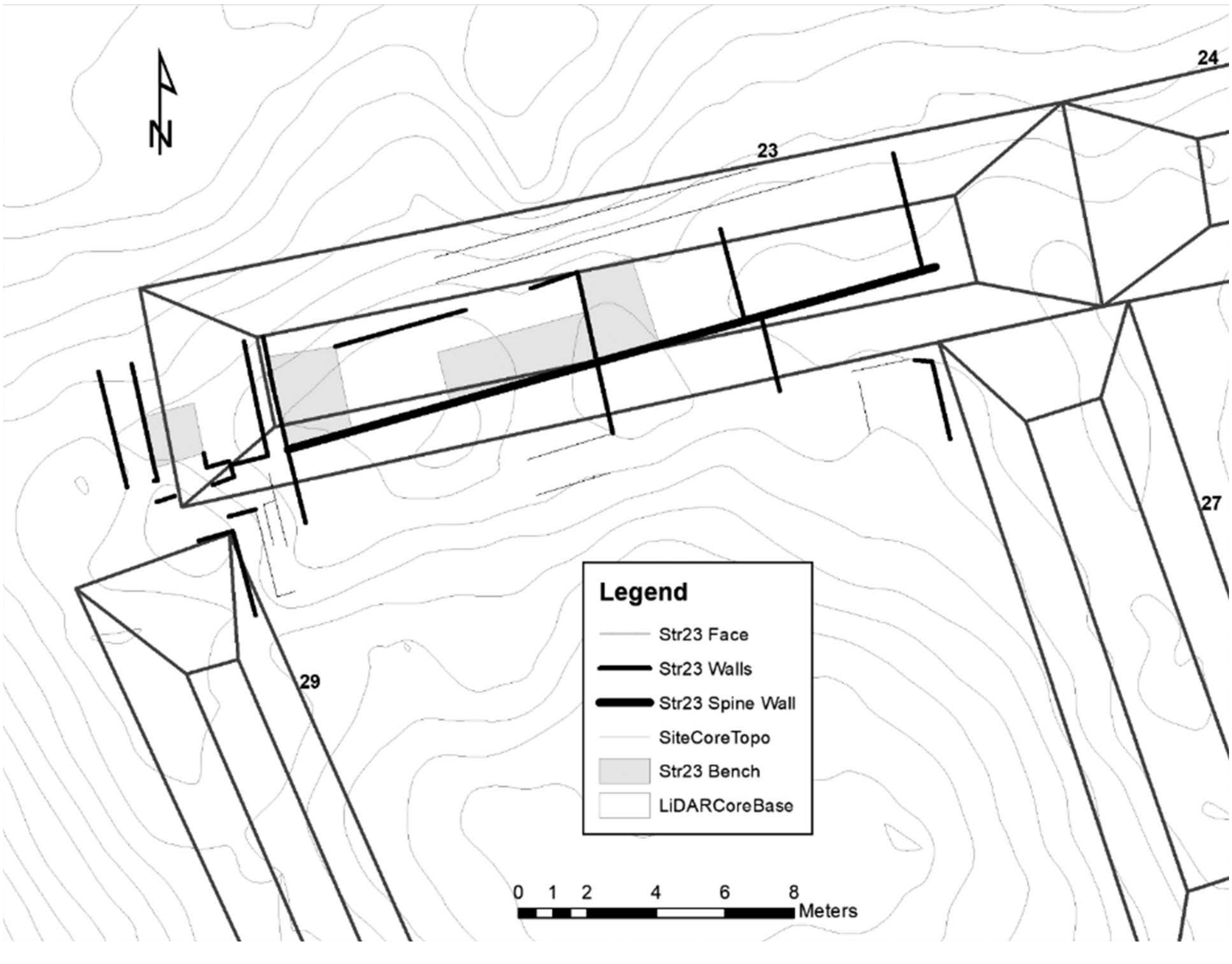


Figure 6.6. Plan map of Structure 23 rooms as excavated by Bill (redrawn after Bill 1987).

and 25). Further discussion below will also show restricted access by an extension building in the southwest corner of Court 2 (between Structure 28 and 29).

Court 3

Initial excavations in 2017 focused on a centrally located 3 m square unit in the courtyard, with following seasons being focused on the eastern structure of the court (Structure 29). The central excavations revealed five caches spread east to west along the central axis of the courtyard. The caches were located between a poorly preserved upper floor 30 cm below the surface (Floor I) and a floor 60 cm below the surface (Floor II). Charcoal from two of the ceramic caches cut into the plaster of Floor II dated to AD 550-650 and AD 545-645, respectively (Cherico and Skaggs 2018). One cist burial (CT3-1) was found to the east and one to the west (CT3-4) of the caches (Figure 6.7), identified by the limestone capstones (Welsh 1988). Both were also cut into Floor II, and cultural material discovered below this floor was from intrusions. All the caches contained numerous pottery sherds (Figure 6.8), but only Cache 1 and Cache 4 contained other types of material. Cache 1 and Cache 2 were found about 10 cm above the other caches.

Cache 1 was the central most cache and contained two layers of artefacts (Figure 6.9). In the upper layer along with the ceramics were a limestone mano fragment, two obsidian eccentrics, a chert eccentric, a *Spondylus* shell bead, and a green jade pendant. Below this layer were two chert eccentrics, an obsidian eccentric, and a fragment of *Spondylus* shell with spines still attached.

Cache 2, the eastern most cache, was found on top of the capstones of the CT3-1 cist burial and consisted of two clusters of ceramic figurines. One appears to be a grotesque face and the other a head with a mouthpiece on the back, both of which might be musical instruments (see chapter eight, this volume). A third potential instrument piece was found 1 m south of these instruments, in the stratigraphic layer just above Floor I. It is in the form of the head of a monkey figure (see Figure 8.11, this volume).

Caches 3 to 5 consisted of ceramic material, except for the jade bead found with Cache 4. Overall, the ceramic analysis suggests the caches span the transition between the Tiger Run Ceramic Complex and Spanish Lookout Complex (Gifford 1976), with common varieties including Mountain Pine Red, Dolphin Head Red, and Belize Red. One Mountain Pine Red dish was found which had been broken into quarters and arranged in a four-layer stack (dish stack in Figure 6.8) at the base of the cap stones of cist burial CT3-1.

West of cist burial CT3-4, two large slate slabs angled further to the west were discovered. Extending the excavation west revealed two disturbed burials (CT3-2 and CT3-3) which intruded through Floors I and II (Figure 6.10). The western most burial (CT3-2) was composed of two individuals, one positioned below a single course of small slate slabs in an intruded pit, with the second individual directly on top of the slabs. On top of the upper individual was a 1 m diameter column of burnt limestone rocks about 0.75 m tall, containing several interesting artefacts. Of the more significant finds was a heavily fragmented Ulúa Valley marble vase (Figure 6.11; Skaggs *et al.* 2019). Interestingly, the fragments were not found together but appeared to be widely dispersed. While many pieces were found beneath, within, and above the burned limestone column and littered about Floor I, others were further afield, found scattered as far as 2 m away from the burial shaft. The upper skeleton was also found associated with other elite grave goods, including two carved conch shell atlatl finger loops, two jade beads, an obsidian eccentric in the shape of a centipede, three marine shell bead tinklers, a limestone spindle whorl, and a cut human long bone (Skaggs and Powis 2018).

The 2018-2019 excavations focused on Structure 29, which was thought to be a single range structure but is actually two buildings separated at the centre by a vaulted alleyway

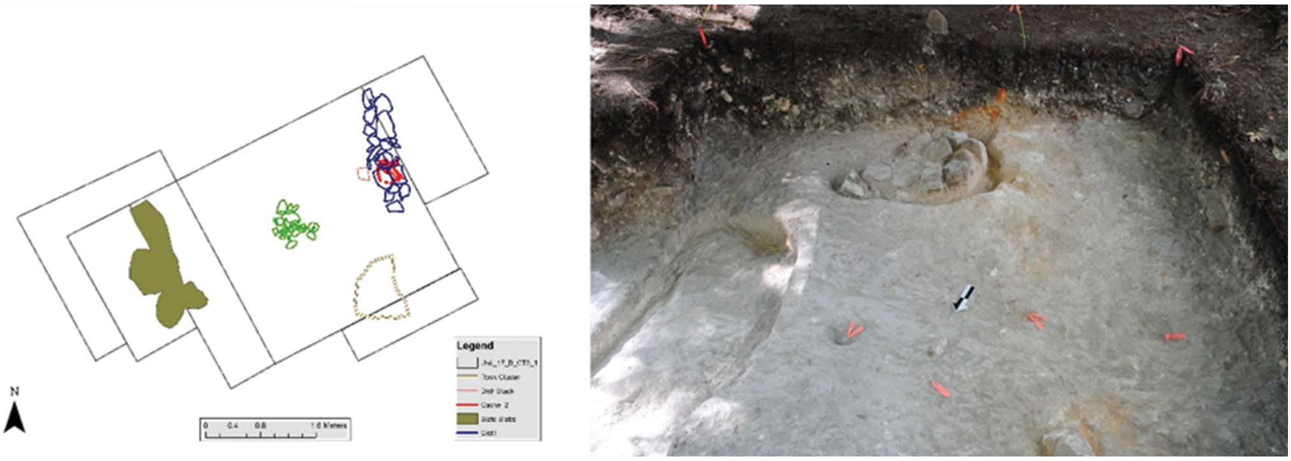


Figure 6.7. Units 17-B-CT3-1 to 17-B-CT3-5 with the potential cosmogram features highlighted (left) to the south, east, and west of the jade pendant cache found in the centre of the courtyard at intersection of axial lines and (right) photo of area, looking south.

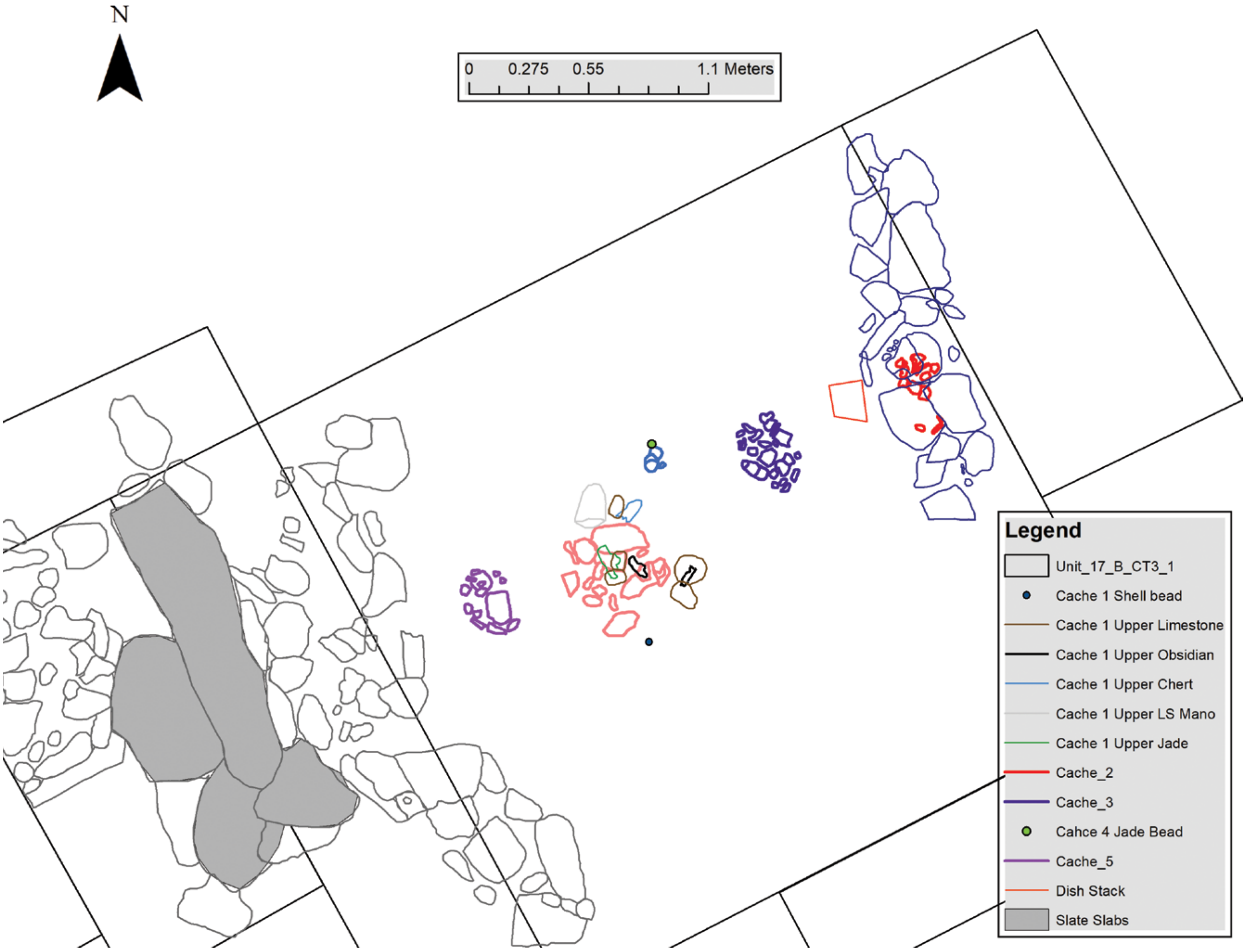


Figure 6.8. Plan map of the locations of Caches 1 to 5 and the dish stack compared to cist burials in Court 3.

connecting Courts 2 and 3. Just above the only plaster floor in this alleyway was a burial in the fill. This fill closed access from Court 2 and Court 3, likely in the Late Classic period. The burial was only 8 cm above the plaster floor, which was 2.75 m below the ground surface. The individual was extended with head to the west. The only other Pacbitun burial with this head orientation is in Plaza C (Arendt *et al*. 1996). Among the fill around the burial was a large fragment of a Daylight Orange: Darknight Variety dish and a spiked censer fragment (Gifford 1976). Also found with the burial were two carved *Spondylus* shell snake-shaped ear flares, olive shell tinklers, a shell bead, a shell disk, and a chert biface. A partial jar rim was found under the skull in the fill (Skaggs 2019). There was an oblong cut into the hard fill under the right leg of the individual that might have contained perishable material. This cut continued down 8 cm, stopping on the plaster floor. It is probable that this burial was intruded through the vaulting of the alleyway and potentially into a slate covered tomb that has been completely cleared away (Skaggs 2019).

From the burial towards Court 3, the alleyway floor slopes slightly higher before descending 59 cm over two steps down onto a 1.2 m wide terrace on the western side of Structure 29 (Figure 6.12). The western edge of this terrace and the top step of a five-step staircase has slumped off due to erosion. The stairway leads from the terrace down to the courtyard surface in Court 3. The stairs extend north of the alleyway entrance by 4.5 m and then curve east and continue 1.5 m before turning north again. Based on symmetry to the south we estimate the outset stair block measures approximately 9 m north to south.

A number of ceramic scatters, Ceramic Scatters 1-4, were found on the same terrace and stair surfaces (Figure 6.12), suggesting the deposits were contemporaneous. One of the scatters, Ceramic Scatter 3, also included two grooved greenstone sphere fragments. Ceramic Scatter 3 had some of the wall stones of the southwest corner of the alleyway shifted on top of the edges of the sherds, proving the scatter was in place before the collapse. The sherds were stacked three high on the north side, with evidence of fill below the stack. The ceramics in this scatter consisted of large dishes and bowls dating to the Late Classic period. It is therefore likely that these scatters were termination deposits made after the structures were abandoned.

Excavations on the western side of Structure 29 revealed rooms on two or three levels, while the eastern side had only a room or rooms on the upper level. Beneath the fill and plaster floors on the western side, the lower level of rooms contained benches along the back walls. These benches

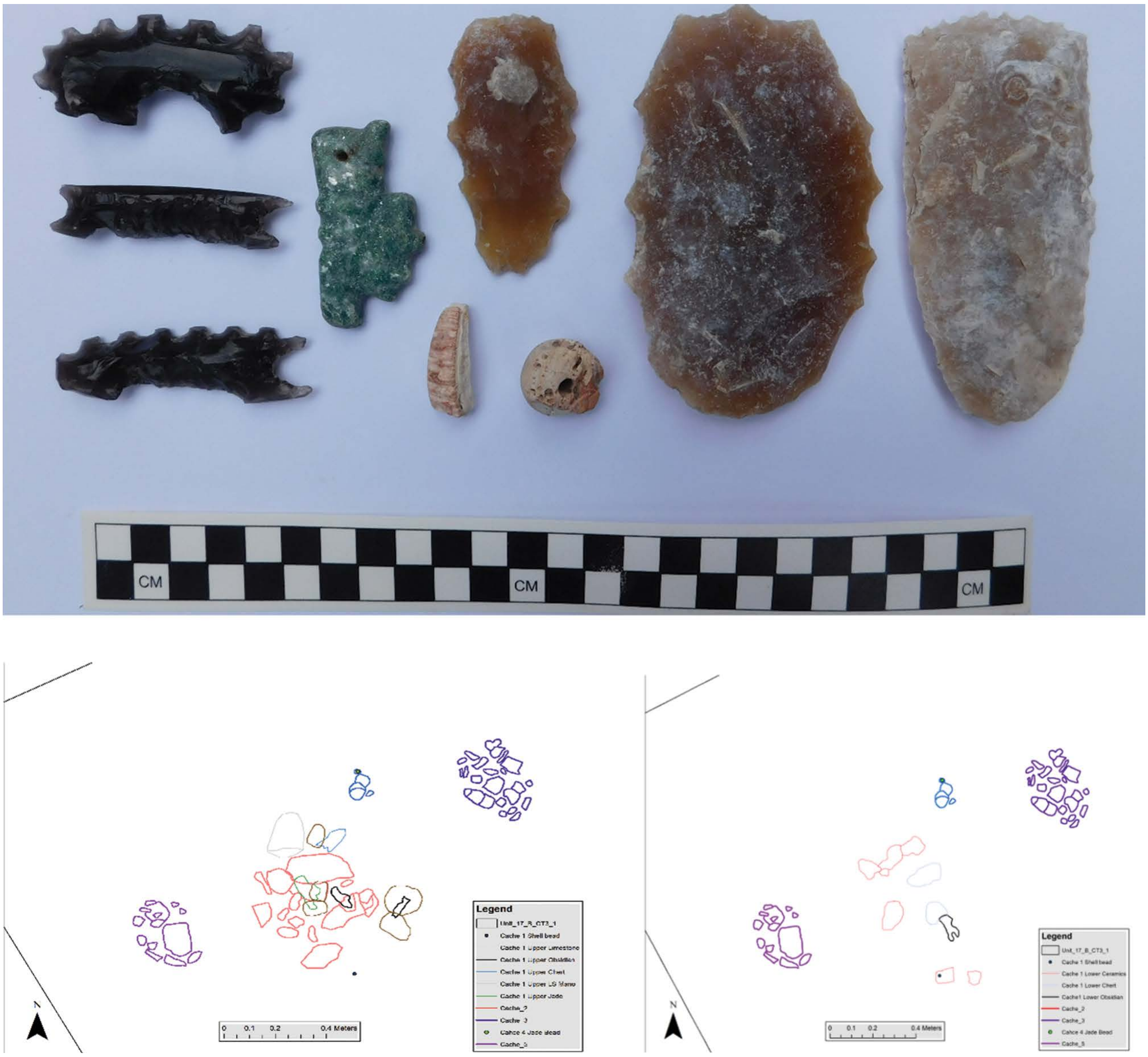


Figure 6.9. Upper and lower layers of Cache 1 with associated artefacts from each layer. The upper two obsidian eccentrics and the right most chert eccentric were found in the upper layer.

were renovated to create new rooms with floors higher up by filling and plastering the rooms to the height of the benches. At a later time, perhaps when the alleyway was also filled in, single course wide stone walls were added on top of the floors. At the same time, or later, the rooms were entirely filled with dirt and rocks (Skaggs 2019).

The southern end of Structure 29 appears to have an extension further south and probably connected to Structure 28. This addition appears to abut the outside wall of Structure 29 with a room that was later divided first north to south, and then again east to west in separate construction events. The extension is at a higher elevation than the extension off the west end of Structure 23, and matches the elevation of the rooms on the east side of Structure 29. A unit excavated into the extension next to the south wall of Structure 29 revealed two plaster floors that had been cut before boulder core fill was added to bring the area up about 1.5 m. Therefore, while the extension would have restricted access between Court 2 and Court 3 at the elevated level of the final construction phase, it is unclear if other construction had already blocked the path between Structure 28 and 29 previously.

Discussion

In deciding the likelihood that Courts 1 to 3 served as royal residences in the Late Classic period, we consider five archaeologically identifiable criteria as suggested by Webster (2001). The first is the impressiveness or monumentality of the overall court grouping. Second is the complexity of the rooms, and numerous modifications which decreased access to or changed the function of the buildings. Third is how private and restricted in nature the courtyards are from other public areas of the site and how access to the courtyards becomes more restricted over time. Fourth is the artefactual accumulation of the courtyards which suggest elite residences. Finally, we consider the

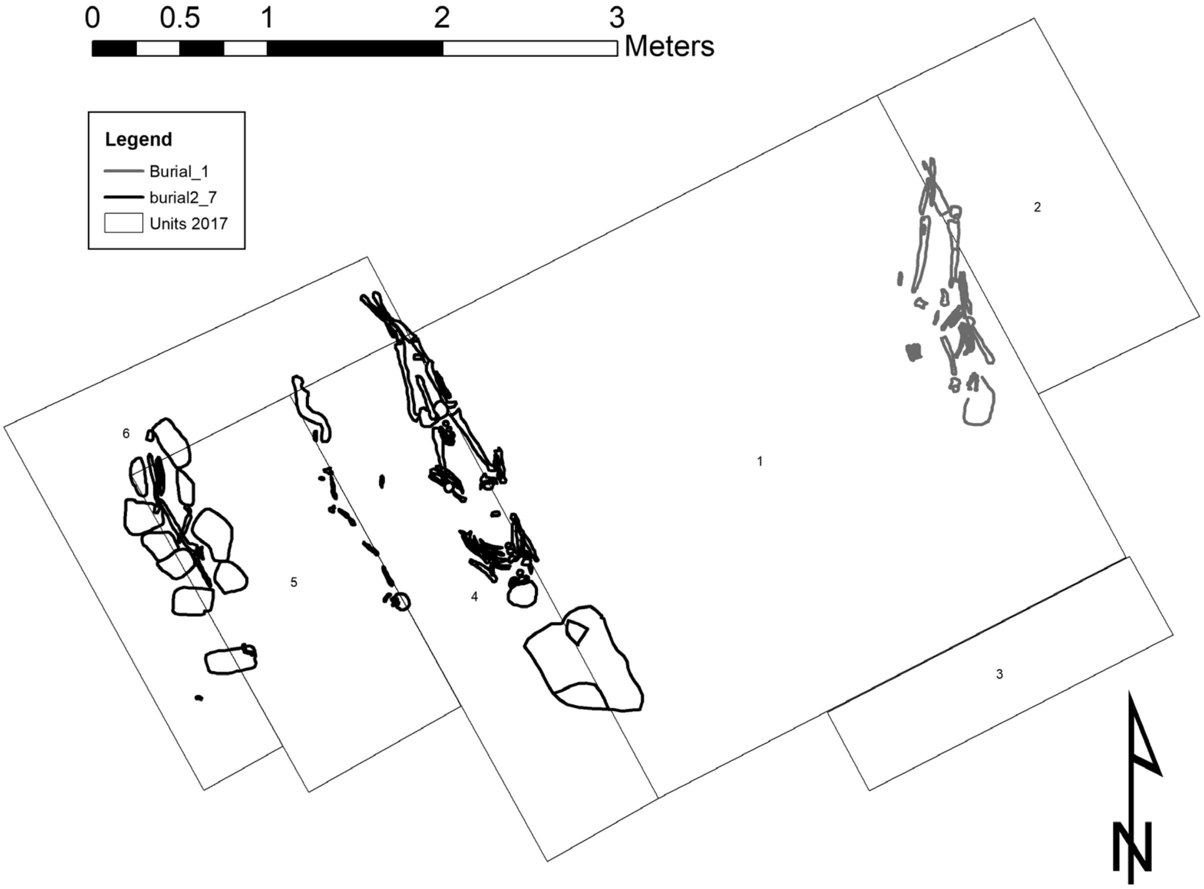


Figure 6.10. Plan map of Court 3 Burials.

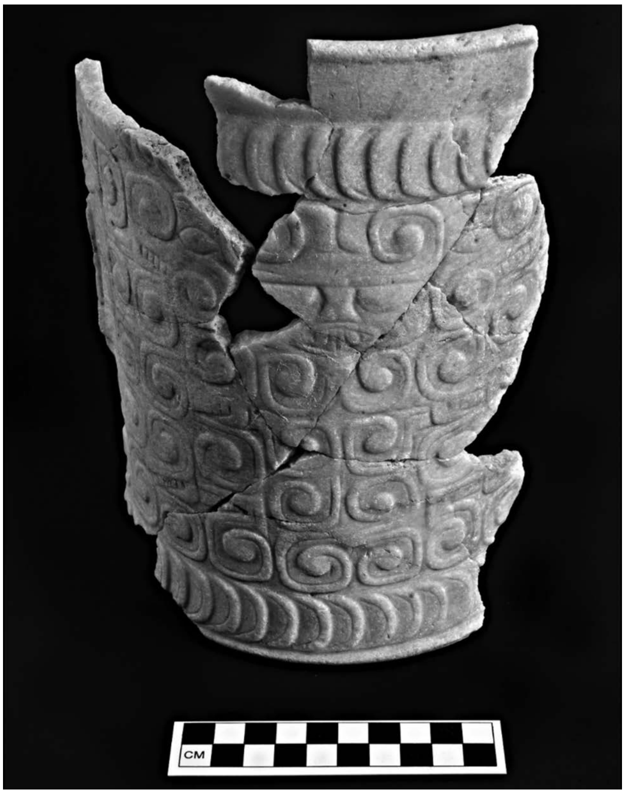


Figure 6.11. Front of largest mended Ulúa Valley Marble Vase fragment (from Skaggs and Powis 2018: Figure 9). Photo courtesy of Jeffery A. Powis.

type and number of burials or ritual offerings in the areas of the courtyards as it relates to occupation and elite residence.

Excavations in Courts 1 and 3 show little evidence of early occupation. Investigations in the courtyard areas of all three courts reveal only one or two plaster floors above bedrock. The courts differ from each other considerably in the quantity, timing, and materials used for levelling the bedrock before the first plaster floor was emplaced. Interestingly, the construction of Courts 1 and 3 appear to be associated with a site-wide Late Classic construction event brought about by a sudden florescence at Pacbitun (see chapter nine, this volume). Since it appears unlikely that Courts 1 and 3 overlay any Preclassic monumental structures, and Court 2 was previously the site of a Middle Preclassic round platform with a different purpose from those in Plaza B, any consideration of a palace function is confined to the Late Classic period constructions. The question then is whether those buildings have attributes which might be considered monumental.

The Late Classic expansive construction effort in all three courts created the stratified elevation sequence these courtyards exhibit today. Great effort was required to bring in the limestone boulders and extra soil required to create these elevation differences, which suggests a function beyond simple necessity. These efforts appear to have all taken place in the Late Classic period. By keeping the floor of Court 3 at 4-5 m below the floor level of Courts

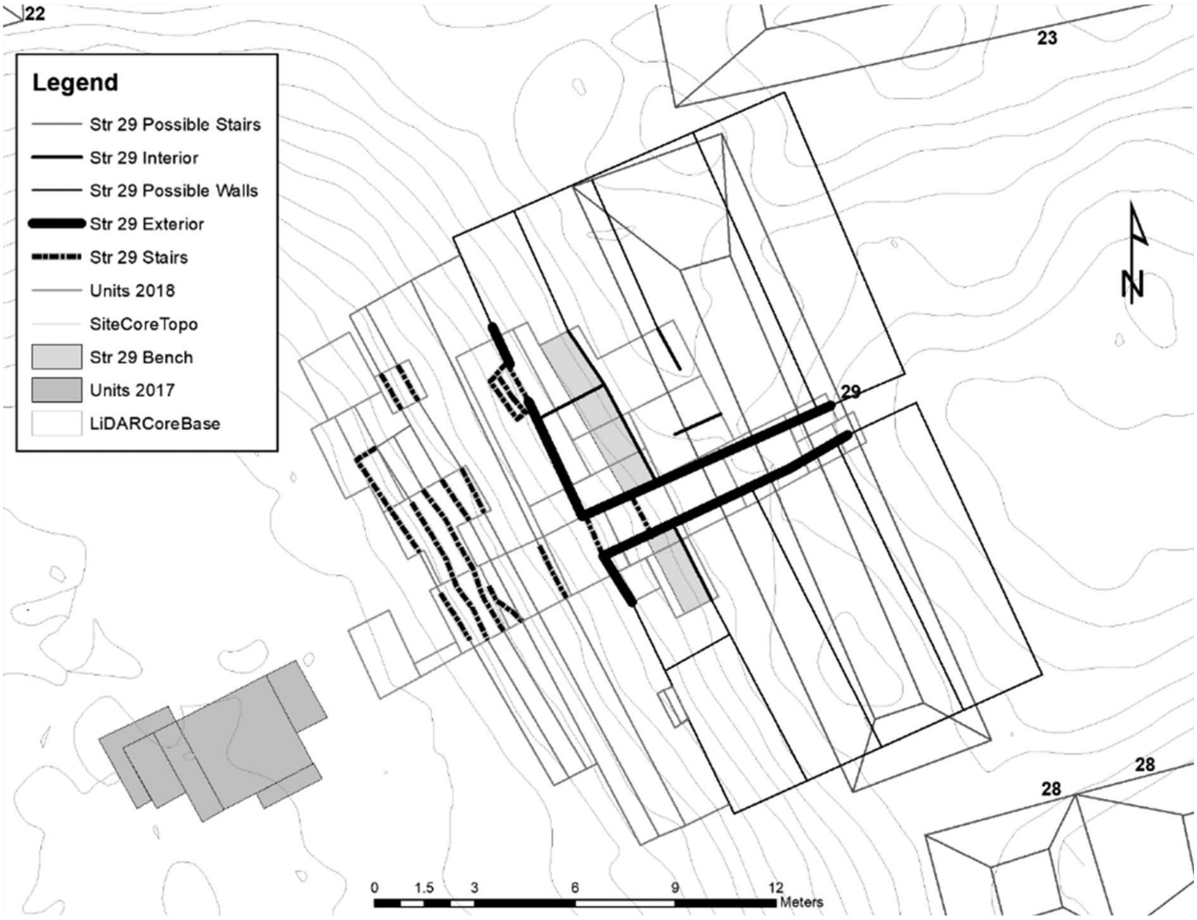


Figure 6.12. Map of Court 3 and Structure 29 stairs, faces, caches, and rooms from 2018 excavations.

1 and 2, while constructing buildings the same heights as elsewhere in the group, some extreme elevations differences were achieved. The relative height difference between Court 3 and its surrounding buildings are some of the greatest in the site core. The difference in height between Court 3 courtyard surfaces and Structure 29 to the east and Structure 22 to the north is 7 m. Only the large ceremonial structures in Plaza A (Structures 1, 2, 4, and 5) and the causeway terminus group (Structure 10), have a greater relative height difference (see Figure 1.2, this volume). Additionally, approaching the site core from the southwest along the Tzul Causeway, travellers would encounter a very steep and impressive slope. From that side of the courtyard group, Structure 30 rises 14 m from ground level to its summit (at 227.5 m above sea level) in a horizontal distance of only 20 m. The other buildings along the southern side increase in elevation, if not in relative height, as the traveller proceeds east towards the altar and stela at the end of Tzul Causeway. There is a ramp seen in the LiDAR data (Figure 6.13) from the south side of Court 3 (see chapter thirteen, this volume) which suggests there was access into or out of the courtyards at this point. Therefore, we find there is significant evidence that the three enclosed courtyards in the site core of Pacbitun represent Late Classic period monumental architecture.

When attempting to consider the complexity of the range structure rooms, the lack of areal excavations limits what can be written about each room. However, enough of Structures 23, 25, and 29 have been uncovered to determine the overall patterns in terms as described by Harrison (2003). Structure 23 started as a moderately complex three-room pattern which Harrison (2003) describes as tandem/non-transverse but is later modified to the most complex room pattern (tandem/transverse) with the addition of the central spine wall and western extension (Bill 1987).

Structure 29 undergoes a similar transformation in complexity in the same order with the addition of the spine wall, alleyway, and the southern extension (Skaggs 2019). Additionally, on the western side of Structure 29 there is the first evidence at Pacbitun of multiple storied rooms in use at the same time. The excavated area of Structure 25 maintains only a moderate level of complexity, with a tandem/non-transverse pattern of rooms. All three buildings contained benches in some of the rooms, though none would fit the descriptions of sleeping benches or thrones as described by Harrison (2003). None were secluded inside rooms, and many were to low or to narrow to be sleeping benches. The benches in Structures 23 and 29 which seem to face the exterior openings of the buildings, like a throne should, lacked the arm rests associated with those features.

In terms of access and function, we know that Structure 23, 25, and the western side of Structure 29, were heavily modified during the Late Classic period. In all cases,

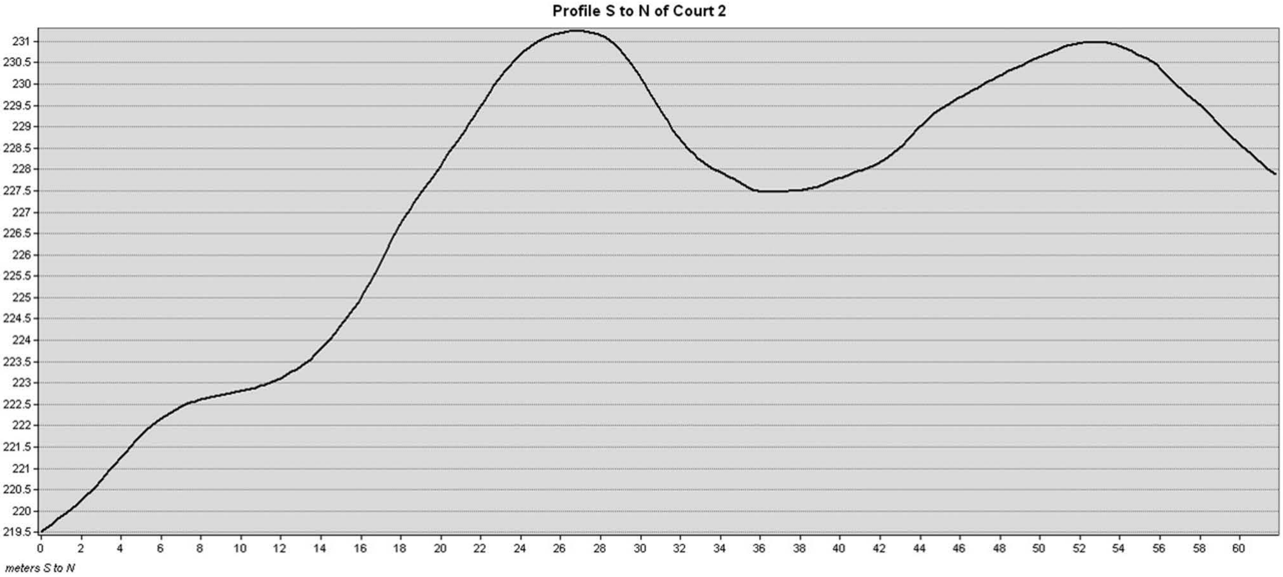


Figure 6.13. Lidar profile of ramp entering Court 3 from south side (left) of Structure 30 and ending in Plaza C (right). The ramp follows the south side of the courts leading away from Court 3 to causeway.

room size decreased and room numbers increased (Bill 1987; Skaggs 2019; Skaggs *et al*. 2017a). On Structure 23, the last phase of construction changed the orientation of the rooms in the building from southern facing to dual facing, with outer rooms facing into both Plaza B and Court 2. A lack of doors in the building centre spine wall prevented travel from Plaza B to Court 2 through the building (Bill 1987). Additionally, excavations at the corners of both Courts 1 and 2 show evidence that the Late Classic period constructions covered over the previous edges of smaller platforms, merging the northern buildings with those running perpendicular to them, and closing off access to the courtyard plazas (Bill 1987; Skaggs 2019; Skaggs *et al*. 2017a). An annex was constructed on the western side of Structure 23 and the southern side of Structure 29, which further restricted the access points into Court 2 from Plaza B and Court 3 (Bill 1987; Skaggs 2019). These restrictions suggest that the area became more exclusive. Currently, it is unclear if the annex was administrative or residential in nature. Access to the eastern courtyard areas probably required travelling through the alleyway between Court 3 and Court 2. This suggests only a limited group would have access, and the residence or public function becomes a symbol of exclusiveness and power. It is concluded that the courts meet criteria two and three by becoming increasingly complex and restricted in nature.

Palaces generally have limited artefactual evidence remaining after abandonment on which to determine the activities or functions of individual courtyards. One exception is the rapid abandonment at the site of Aguateca, Guatemala where numerous artifacts were found (Inomata 2001). If artefacts are present, then a royal palace would be expected to reflect both the domestic and ritual/public consumption by those living within the court. At Pacbitun, no middens have been found that directly relate to the Late Classic court structures; however, counting a few artefact types such as spindle whorls, manos, and metates, we may be able to identify a domestic function (Table 6.1). It is apparent that spindle whorls, manos, and metates are in much greater abundance within the structures than in the courtyards. Those artefacts more related to ritual or public activities like obsidian blades and jade beads/pendants are much more evenly distributed between structures and courtyards. These, along with areas of patchy burning noted on interior room surfaces next to walls, suggests that despite the lack of sleeping benches, there was probably production for domestic needs and potentially cooking. Though limited, it appears there is some evidence for domestic activities in the courts, suggesting they served, at least in part, a residential function.

Finally, evidence of the ritual importance of the courts is observed in the excavations of caches in and around

Table 6.1. Summary of special finds in the courts and excavated court structures.

Artefacts Found in Courts 1-3						
Type	**# Str 23**	**# Str 25**	**# Str 29**	**Court 1**	**Court 2**	**Court 3**
Spindle Whorls	2	3	5	0	2	1
Metate Fragments	11	4	9	1	3	3
Mano Fragments	21	17	34	11	8	4
Obsidian Blade Fragments	28	13	100	14	29	14
Jade	3	2	1	0	1	2

Structures 23 and 25 (Bill 1987; Skaggs *et al*. 2017a). These alone aren't particularly uncommon in Maya construction of buildings. However, at the northern end of Structure 25 a piece of a broken carved altar fragment was found incorporated as part of the base of a centre wall (see Figure 6.4). Possible ritual use of the Altar 3 fragment is suggested by the large ceramic scatter on the plaster floor directly in front of the fragment (Skaggs *et al*. 2017a; Skaggs *et al*. 2017b). There was also significant ritual investment in Court 3 during this time. A total of five centreline caches were found in the centre of the plaza area. These not only consisted of simple ceramic plates and cups but also included jade and eccentrics of chert and obsidian which are rare at Pacbitun (Cherico and Skaggs 2018). The centre cache containing the jade may be part of a cosmological arrangement, since it matches the colour and positions of a world cosmogram. The colours should be red to the east, black to the west, yellow to the south, and white to the north (Lucero 2010). About 1.5 m around the centre cache are the following: red pottery was found to the east, black slate slabs to the west, and a potential cache of yellow material to the south (see Figure 6.7). Any white coloured north deposit might not have been excavated or was lost in the white marl above bedrock.

Also, in Court 3 the burials both east and west of the caches is the best evidence of a royal residence. Royal households (palaces), just like commoner households, include the tombs and burials of their ancestors and relatives (Webster 2001). These burials represent the highest concentration of elite burials at Pacbitun outside of Structure 1 (Table 6.2). It

Table 6.2. Summary of site core burials at Pacbitun, updated to include burials in Plaza A, Eastern Court, Courts, and Structure 3. Modified from Robertson (2011).

Burial	Period	Area	Gender	Type	Position	Head Direction
1-1	Late Classic	Str 1	F	partial cist	extended, supine	N/A
1-2	Late Classic	Str 1	M	simple crypt	extended, supine	S
1-3	Terminal Classic	Str 1	M, F, J	partial cist	extended, supine; J vessel	S
1-4	Late Classic	Str 1	F	elaborate crypt	extended, supine	S
1-5	Late Preclassic	Str 1	M	simple crypt	Unknown	S
1-6	Early Classic	Str 1	M, F	elaborate crypt	M extended supine; F seated	S (M)
1-7	Terminal Classic	Str 1	M, F	cist, capped pit	extended supine	S
1-8	Late	Str 1	F	elaborate crypt	extended supine	S
1-9	Late Classic	Str 1	M	tomb	extended supine	S
2-1	Terminal Classic	Str 2	F	simple crypt	Extended	S
2-2	Terminal Classic	Str 2	M	simple crypt	extended, prone	S
2-3	Late Classic	Str 2	M, F	elaborate crypt	extended, supine	S
2-4	Late Classic	Str 2	M	cist, capped pit	extended, supine	S
2-5	Terminal Classic	Str 2	J	simple-pit, urn	probably flexed	N/A
2-6	Terminal Classic	Str 2	J	simple-pit, urn	probably flexed	N/A
3-1	Terminal Classic	Str 3	U	cist	extended, supine	S
4-1	Late Classic	Str 4	F	elaborate crypt	Extended	S
4-2	Late Classic	Str 4	M, F	cist	Extended	S
4-3	Early Post Classic	Str 4	F	simple pit	Flexed	N/A
5-1	Late Classic	Str 5	M	simple crypt	extended, supine	S
5-2	Terminal Classic	Str 5	U	simple pit	Unknown	N/A
29-1	Early Post Classic	Str 29	U	simple pit	extended, supine	W
A -1 & 2	Late Classic	Plaza A	U, U	cist	extended, supine	S
C-1	Late Classic*	Plaza C	U	simple pit	torso extended, lower legs flexed, prone	W
CT2-1	Middle Preclassic	CT 2	J	cist	extended, supine	S
CT3-1	Late Classic	CT 3	U	cist	extended, prone	S
CT3-2 & 3	Terminal Classic	CT 3	U, U	cist	Extended	S
CT3-4, 5, 6	Late Classic	CT 3	U, J, J	cist	extended, prone	S
CT3-7	Late Classic	CT 3	U	cist	Extended	S
EC-1	Late Classic	Str 38	J	simple pit	Skull only	U
EC-2	Late Classic	Str 37	U	simple pit	extended, supine	S
EC-3	Late Classic	Str 37	U, U	simple pit	extended, supine	S

* Previously misidentified as Middle Preclassic due to ceramic mixing.

is likely with more intense excavations focusing on benches and stairs, additional elite burials will be found.

Conclusions

The construction of increasingly restricted space, the extreme relative height differences compared to other site buildings, the extra construction effort used to create elevation differences, and the important ritual activities all set the courts apart from the more public portions of the site. Additionally, the causeway running along the southern edge of the courtyards, and access into the courts through Court 3, made sure that those viewing or moving through those spaces would notice their grandeur. However, the courts also show evidence of domestic or household activities or functions at the same time. This accumulation of evidence, which matches the criteria of monumentality, complexity, increasing restriction, and evidence of elite residence, means that we can safely remove the quotation marks from around the word 'palace' – or at least signify it is the place of royal residence – when describing the courts and courtyards south of Plaza B in Pacbitun.

Acknowledgements

We are grateful to the Institute of Archaeology in Belize, specifically Dr. John Morris and Melissa Badillo, for their support of the Pacbitun Regional Archaeological Project (PRAP). A special acknowledgement goes to the Alphawood Foundation for financially supporting PRAP. Kristin Hettich, of Alphawood, deserves acknowledgement for her continual support for our research. We would also like to thank Mr. Alfonso Tzul, the landowner, who graciously allowed us to excavate on his private land, and would like to express our appreciation to all the local people of San Antonio village for their constant support throughout the season. This chapter would not be possible without the Pacbitun staff that commit their time and effort to the project in and out of the field including: Nicaela Cartagena, Kaitlin Crow, Mike Mirro, Andrew Vaughan, Jeff Powis, and Adam King. Finally, we thank the Bronx Community College Geospatial Center for their help with ArcGIS and mapping of the project.

7

Modelling Pacbitun: Experiments in Spatial Data

Andrew J. Vaughan, Brian Gil, Peter Cherico, and Jeffrey A. Powis

The Pacbitun Regional Archaeological Project (PRAP) has made use of innovative survey techniques since its inception in 2008. Expanding both the total area covered and increasing the levels of accuracy, precision, and detail with which areas can be recorded has continued to be a goal of innovation in spatial survey at Pacbitun. Spatial recording experiments at Pacbitun have included the use of both terrestrial (Weber and Powis 2013) and airborne (Weber and Micheletti 2016) LiDAR and more recently 3D Structure from Motion (SfM) photogrammetry (Spenard and Mirro 2017; Spenard *et al*. 2018; Vaughan *et al*. 2016; Vaughan *et al*. 2018). The introduction of Terrestrial Laser Scanning (TLS) to the tool suite at Pacbitun by Weber and Powis (2013) marked the first foray into technologies which have been grouped together by other researchers under the umbrella of High-Density Survey and Measurement (HDSM) (Opitz and Limp 2015). Recent geophysical investigations at Pacbitun can also fall under this umbrella (Skaggs *et al*. 2016b). However, while analogue in their use of tape measures, compasses, and other physical/optical means of survey, even the early surveys reported on by Healy in chapter two of this volume as well as by Healy *et al*. (1990a, 2007) still incorporated satellite radar imaging and greatly increased the density of measurement and area covered when compared to other spatial surveys conducted at that time.

HDSM techniques present both opportunities and challenges for researchers at Pacbitun. In 2015, a programme of SfM photogrammetry was implemented to record the main excavation unit within Plaza A (Vaughan *et al*. 2016). In 2016, photogrammetry was utilised for data acquisition in Slate Cave (Spenard and Mirro 2017) and then subsequently to document human modifications throughout the karstscape of the Pacbitun region (see chapter ten, this volume). In 2017, the largest photogrammetry acquisition to date took place during the summer field season (Vaughan *et al*. 2018). Photogrammetric recording of excavations continued in 2018, and the acquisition method has continued to be refined and streamlined.

Challenges to 3D modelling at Pacbitun have included issues with variable lighting quality, the complex geometry of Maya architecture, and persistent, dense vegetation across the site. The opportunities for the immediate future lie in the increased efficiency with which more detailed data may be recorded from sensitive exposed excavations and conveyed in traditional 2D plan and profile renderings. The integration of multiple seasons of excavation into a single model to produce traditional 2D architectural plans has received the bulk of current attention from the authors of this chapter. In the longer term, true 3D delineation (Kimball 2016) of these models is possible, when answers to research questions would be enhanced by such an endeavour. We take a flexible, multi-scalar, iterative and integrative approach to mitigate these challenges in order to incorporate the advantages of HDSM techniques into the everyday practice of archaeology at Pacbitun. By iteratively implementing photogrammetry, we have created a data archive which can maintain interpretive consistency with older methods, while simultaneously improving those methods where possible and providing the raw data for future, fully 3D recording methods.

The trials and tribulations of integrating photogrammetry into the intense schedule of fieldwork during summer field seasons in Belize cannot be overstated. The primary challenge has and will continue to be the acquisition of well-lit photographic source data beneath the forest canopy, while balancing this with the necessity of protecting sensitive exposed architecture from the elements. Data acquisition, software choice, processing settings, post-processing, presentation, distribution, and archiving are all evaluated through the lens of practising archaeology at Pacbitun. Through these results we aim to establish a set of flexible guidelines to streamline and standardise the collection and interpretation of detailed 3D data into the research workflow. These guidelines are built flexibly to adapt these methods to the challenges of field archaeology at Pacbitun while integrating the use of 3D models at multiple scales into the existing archaeological toolbox.

Theoretical Framework

Opitz and Limp (2015:347) define HDSM as follows:

> ‘[T]he collective term for a range of new technologies that give us the ability to measure, record, and analyze [sic] the spatial, locational, and morphological properties of objects, sites, structures, and landscapes with higher density and more precision than ever before.’

Archaeological recordation in general, and mapping in particular; is an exercise in abstraction (Ashmore 2002; Crampton and Krygier 2005; Gillespie 2011; Monmonier and Blij 1996). In mapping archaeological data, archaeologists translate commonly accepted ways of seeing architecture, soil disturbances, artefacts and taphonomy into scale planimetric and profile representations (Ashmore 2002). As has been identified by the scholars cited above, this process is by its very nature and purpose not objective. The goal is to record that which is significant to the investigator for future reference by others unable to visit the site in the state in which the map is produced (this includes the investigator's future self). This is a subjective endeavour, rooted in the perspective of the investigator.

Understanding the context within which a representation was produced, whether analogue or digital, 2D or 3D, spatial or statistical, is crucial to effectively interpreting that representation. Establishing conceptual links between archaeological ways of seeing architecture, soil disturbances, artefacts, and taphonomic processes and the technical means of abstracting, measuring and then recording what is seen is crucial to the successful long-term implementation of a programme of recordation. This is true regardless of the level of technological sophistication the method involves. In this light, the various forms of spatial recording and representation can be seen as existing in a multi-dimensional space, with methods of recording laid out in accordance to the density and accuracy of their measurements on some axes. Other axes would lay out methods according to time cost, intellectual overhead, financial investments, environmental suitability, and other limiting factors. All methods of spatial recording from a sketch map on scrap paper to micron accurate digital 3D models exist within this multi-dimensional conceptual space.

Navigating this space will not and should not work identically for every project or even every investigator. Different axes will hold different weights, depending on the context. The overhead for learning photogrammetry, for example, will vary from project to project and investigator to investigator. Access to advanced equipment, institutional support, or expert personnel can reduce start-up costs for a given method and influence adoption. Environmental peculiarities might disadvantage one method or afford an advantage to another. It becomes clear in this light that even what might be considered the standard methods for archaeological recordation like architectural plans or stratigraphic profiles are in fact the result of a complex negotiation between many factors, not all of which bear any direct relation with archaeological concerns or questions, though undoubtedly such considerations should factor heavily into decision making with regards to spatial representation.

Limp (2016:349) addresses this conceptual space in his discussion of HDSM:

> 'The analytical process that characterized [sic] our field before HDSM can be (over-) simplified to a sequence of observe, interpret/abstract, measure, record, and analyze [sic]. HDSM breaks us out of this process in that it pushes us toward a recursive and reflexive engagement with the data, in which we observe, record, measure, analyze [sic], and abstract/interpret repeatedly, and in various orders.'

In separating observation, abstraction, measurement, recording, and analysis with certain techniques, recording can be performed without having first abstracted and measured through the lens of the archaeological perspective. In analogue/manual mapping the abstraction, measurement and recordation phases of Limp's (2016) analytical process take place nearly simultaneously as the map is physically being produced. These steps cannot be revisited later, and representations created using these methods must by their nature become the canonical representation for the phenomena represented.

With HDSM, having recorded an area through technological means such as laser scanning or photogrammetric modelling, measurements, abstractions, analyses, and comparisons can be performed arbitrarily ex post facto with a reduced need for an investigator to personally, physically observe potentially inaccessible (Hess *et al*. 2015; McCarthy and Benjamin 2015; Rissolo *et al*. 2017), fragile (Fassi *et al*. 2015; Plets *et al*. 2012), or no longer present (Balletti *et al*. 2014a; Balleti *et al*. 2014b; Harmanşah 2015) archaeological evidence. Investigators can take time, mapping in detail in a laboratory setting which would have been practically impossible to record in the field with limited time and resources. Abstractions of evidence may be drawn and redrawn, should later changes to spatial communication conventions or theory cause older graphic representations of archaeological sites to be misread, as happened with Gillespie (2011) at La Venta, Mexico. It is this recursive engagement with data rather than the specific technical capabilities of given technologies, whether Airborne Laser Scanning (ALS), TLS, geophysical sensing (Skaggs *et al*. 2016b), or photogrammetry, that continues to attract investigators at Pacbitun to HDSM techniques. This recursive re-engagement with the data was the purpose of the implementation of LiDAR mapping for archaeological prospection at Pacbitun by Weber and Micheletti (2016), utilising data acquired by Chase *et al*. (2014) as part of their 2013 West-Central Belize LiDAR Survey.

Making changes to spatial recordation methodologies within existing archaeological research programmes is not to be undertaken lightly. Gillespie (2011) examined the impacts that changes in mapping practice had on the long term understanding of a standing architectural complex at the site of La Venta. In that case, the shifts in style and method of mapping were undertaken without intent and without understanding of the cognitive negotiation taking place in the construction of archaeological representations. Lack of acknowledgement of the situatedness of this spatial data caused later researchers to interpret older maps in the context of what was then contemporary mapping practice, as opposed to the context in which they were originally drafted. Similarly, the extremely photorealistic nature of 3D models can lend a false sense of accuracy or precision to generated 3D models. 3D models cannot fully substitute for in the field, 'in the dirt' experience with archaeological remains, however they can provide a middle ground between such experience and simply relying on hand drawn mapped data in terms of representation. It is critical to document the cognitive negotiations which lead to a given representation in order to understand both the accuracy and precision of such a representation. It is crucial to remember that this is true for all archaeological representations, and not just HDSM models, as the discipline generally has simply not acknowledged the situatedness of the archaeological knowledge represented in hand drawn paper maps.

HDSM differs from traditional, hand drawn paper and profile representations in that the accuracy and precision of such models are easily quantifiable within the processing and analysis software used to produce those models. The acknowledgement of the possibility of error and documentation error rates within digitally produced archaeological representations should not be mistaken for inherent inaccuracy. In fact, this differs from hand drawn representations in that the recognition of the possibility of error is measurable and comparable. With hand drawing a palimpsest of factors including individual skill, tape measure quality and age, temperature related expansion/contraction and even drawing implement sharpness can lead to error which is usually not quantified or even acknowledged. At Pacbitun, a 2D baseline method is typically used as opposed to a cross braced, trilateration-based survey network, due to the need to draw maps in the field as opposed to waiting until post-processed trilateration-based measurements are available. While this allows for the capture of more fine detail by a skilled mapper, the method is more prone to the introduction of error. HDSM techniques can provide an improvement both in the level of detail achieved and the accuracy of the acquired data.

Returning to the conceptual space of representation techniques, SfM photogrammetry competes favourably with terrestrial laser scanning (TLS) previously implemented at Pacbitun in terms of ease of implementation as well as financial and time costs. Comparative studies have found varying quality in the software packages used to implement SfM photogrammetry (Brutto and Meli 2012; Kersten *et al*. 2015; Lerma *et al*. 2010; Marčiš 2013; Olson *et al*. 2013; Quartermaine *et al*. 2014; Tucci *et al*. 2015; Verhoeven *et al*. 2012). Agisoft Metashape (formerly known as Photoscan) has been documented to produce models with 95 percent of the accuracy of TLS even across large standing structures with interior rooms (Kersten *et al*. 2015). Considering that photogrammetry can be achieved with almost any digital camera (though model quality is directly tied to camera quality) commonly found on an archaeological site today, achieving even 90 percent of the accuracy of TLS for a fraction of the cost seems like an obvious trade off worth making. Even if models are never produced, digital images are essentially free to collect, and should be collected whenever possible.

The models produced by this project likely do not approach the 95 percent comparative accuracy to TLS, as documented by Kersten *et al*. (2015); however, TLS data for the subsurface excavations was not available to provide a direct comparison. Efficiently and consistently achieving accurate spatial reference for 3D models produced at Pacbitun continues to be somewhat problematic. The rural setting, rugged terrain, steep architecture, and primary forest nature of the site continue to provide challenges for electronic distance measuring (EDM) technologies like total stations and TLS scanners, as well as direct measurement technologies like survey grade Real Time Kinematic Global Positioning System (RTKGPS) hardware. The current status of the site as an active forest garden also precludes the large-scale clearing necessary for efficient use of EDM techniques, and the canopy also degrades the reliability of GPS. Where full spatial control was achieved, the models produced achieved a measured accuracy of under 2 cm as measured by the Metashape error measurement tool.

This chapter is intended to serve as both a documentation of the extant photogrammetric data collected at Pacbitun as well as a guide for the future implementation of HDSM and photogrammetry techniques at Pacbitun. A thorough accounting of the data collected to date is given along with an honest inspection of the shortcomings of said data. Recommendations for future collection of HDSM data are made, including recommendations for the integration of collected HDSM excavation models with available LiDAR data as well as historical survey data to more completely understand the relationship between extant surface and buried architecture at Pacbitun.

Methodology

The production of 3D models does not start with the modelling software, and the archiving of HDSM data should not be limited to completed models. For archaeological purposes, 3D modelling must be undertaken in a controlled, measurable way. For the authors of this paper, modelling begins with the capture of photographic and spatial data about the scenes in question. Spatial data are collected and processed to be able to effectively scale the produced models from unit corners and other easily identifiable reference points which will be visible in models. Photographic data is captured utilising a shifting perspective and a minimum of 60 percent overlap from one photo to the next, based on previous experience and trial and error with the particular equipment setup available at Pacbitun. The photographic data is processed once in the field using the 3D modelling software; however, these models are not of scientific quality and are only used to provide a rough coverage test of the acquired data. The final models are produced from the camera RAW data, which contains the unprocessed sensor data and is free of processing artefacts that can distort the resulting model. The RAW images are processed in open source software RawTherapee to provide colour corrected JPEG images which serve as input for the commercially produced modelling software. Once the RAW images are processed into JPEG images, the workflow moves from photo pre-processing to model processing, typically in Agisoft Metashape.

Agisoft Metashape has been the software of choice for many of the photogrammetric models produced at Pacbitun thus far. Metashape has several advantages, primarily with regards to the flexibility in the quality of the model produced. Agisoft allows for different processing steps to take place at different levels of detail, depending on the requirements of the user, time constraints, and available hardware. For the in-field coverage tests, processing on lower quality can be done very quickly. For production quality models, higher setting levels and larger images can be used for greater fidelity in the end-product. The primary factor limiting the use of Agisoft Metashape to produce 3D models has been the performance requirements of the host computer system—3D photo modelling is an incredibly resource intensive operation no matter what quality level is used. Other software used for photo modelling at Pacbitun has included Zephyr's 3DFlow photogrammetry package, which has been used by authors Gil and Cherico as well as Skaggs for experiments in photo modelling. Senior author Vaughan has also experimented with Capturing Reality's RealityCapture software package. However, the models reported on in this chapter have all been produced using Agisoft Metashape, apart from one model produced in Zephyr 3Dflow by Skaggs.

Once the models have been produced, the workflow moves into a post-processing phase. This post processing is where the most reflexive re-engagement with the acquired data is possible. The primary post-processing currently performed is the production of scaled orthographic plan and profile images of the models. These 2D images of the modelled 3D data retain an interoperability with traditional plan and profile drawings already produced while on site. These orthographic representations can be used in the illustration software of choice for a given researcher, over which 2D vector data can be illustrated in a digital, laboratory-based analogue to the 2D plan and profile methods already in use at Pacbitun. Far more detail can be included in maps derived from model-derived 2D orthographic representations than is possible in the field, but the maps retain interoperability with the legacy mapped data collected at Pacbitun for decades. Another form of re-engagement with the modelled data discussed in this chapter are the efforts to produce unified models of multiple seasons of excavation data, resulting in synthetic models of buried structures, bringing together and representing literally years of effort in the field. This has been attempted in the past (Spenard *et al*. 2018) with the expensive commercial software package 3DReshaper, primarily for the purpose of integrating modelled data with TLS LiDAR data. Previous attempts to unify multiple seasons of excavation data have met with some early success in 3DReshaper, though the cost associated with that software remains a significant challenge to widespread adoption. This chapter reports on the use of the Open Source software packages Cloud-Compare and Meshlab as a viable combination in replacement of the functions available in 3DReshaper, particularly when it comes to manipulating models produced from photographs. In chapter ten of this volume, Spenard and colleagues describe their method of drafting plans in ESRI ArcMap utilising DEM and orthomosaic data derived from photogrammetric modelling. We also propose additional solutions to the differences in colouration on models produced in different seasons first observed by Spenard *et al*. (2018).

Data Acquisition: Photographic Data

The principles of imagery acquisition for StfM photogrammetry have been discussed before, specifically for work at Pacbitun (Spenard and Mirro 2017; Spenard *et al*. 2018; Vaughan *et al*. 2016; Vaughan *et al*. 2018). This is in addition to many other discussions of photogrammetry for general archaeological purposes (Balletti *et al*. 2014a; Balletti *et al*. 2014b Brutto and Meli 2012; Fassi *et al*. 2015; Harmanşah 2015; Hess *et al*. 2015; Kersten *et al*. 2015; Lambers *et al*. 2007; Lerma *et al*. 2010; Marčiš 2013; McCarthy and Benjamin 2015; Olson *et al*. 2013; Plets *et al*. 2012; Quartermaine *et al*. 2014; Rissolo *et al*. 2017; Tucci *et al*. 2015; Verhoeven *et al*. 2012). The general principal of SfM photogrammetry may be summarised: through computational matching of overlapping images with a shifting perspective, orthographically correct 3D models may be produced of real-world objects and places. When coupled with scalar and/or positional reference, these models may be measured and/or mapped onto the real world.

At the Pacbitun site core, photographic data for the purposes of 3D modelling has been captured by site photographer Jeff Powis since 2015, except in urgent cases where he is not available. Co-author Powis utilises a full frame Nikon D800 SLR for all site photography, including photogrammetric modelling. Images on the D800 were acquired with a 17mm focal length lens. A wide angle (but non-fisheye) lens allows for more image overlap while decreasing the total number of images required to achieve the desired overlap coverage. This comes at the expense of total resolution; however, the 36.3 megapixels captured by the Nikon (Model) result in a pixel size of well under 1 cm, depending on the scale of the unit being recorded. Balancing the total number of images with the available time remains one of the primary practical considerations to produce photogrammetric models at Pacbitun.

Images are captured in RAW+JPEG mode for in field flexibility as well as high quality archival purposes. The often-sensitive nature of archaeological investigations means that when recording excavated features now exposed to the elements, time can be exceedingly short. With photogrammetry, missed photographs, or poor coverage overlap can result in errors in modelling. Removing tarp coverings protecting units from the elements in the tropical forest setting in west-central Belize is a risky, time sensitive, and usually one-way process, only undertaken at the end of the season for final recording. Backfilling is usually performed within hours of the removal of tarp coverings to protect fragile, buried architecture from the unpredictable and sometimes intense tropical weather. Often a single opportunity is all that is available for imagery acquisition. This is where the JPEG images automatically produced by the camera in RAW+JPEG mode come into play. By processing a test run of the images acquired in the field, gaps in coverage or other issues with the model such as image alignment or lighting may be observed, identified and addressed iteratively as a component of the recording phase. This step may not be necessary for simple capture scenarios involving a 1 m^2 or 2 m^2 unit; however, for complex, buried architectural features it can be difficult to predict all the angles which will be necessary to effectively capture the entire scene. By processing a test capture in the field, these issues can be mitigated by re-capturing or supplementing the capture with additional spot coverage images.

Data Acquisition: Spatial Data

Acquiring spatial control for the recorded excavations continues to be more complicated than acquiring effective imagery for 3D reconstruction. In 2015, issues with total station data quality resulted in a poor correlation of the model to the recorded reference locations (Vaughan *et al*. 2016). In this case, back-up scalar measurements were required to scale the models. In 2017, a Trimble Real Time Kinematic Geographic Position System (RTK-GPS) receiver pair was added to the Pacbitun tool suite, in line with the recommendations of Cartagena *et al*. (2017). This receiver pair produces a real-time position corrected to, in theory, sub-1 cm resolution (Trimble 2003) using a rover and base station setup. In 2018, co-authors Cherico and Gil utilised a more modern and much cheaper RTK-GPS system from a hardware start-up known as Emlid for the same purpose.

Both systems should allow for the quick acquisition of an accurate, geographically referenced position for documented reference points. These are often unit corner nails or datums at Pacbitun. This data is tied to the corresponding images of the reference points as represented within the processed 3D model, resulting in a model which is measurable and referenced to real world positions and can be correlated with other geographic data from LiDAR to previous maps and surveys. Canopy density, challenges with radio reception, line-of-sight considerations, and even the protective tarp coverings protecting the units from the elements have prevented these systems from working to the full potential of the technology at the site of Pacbitun, except for the 2017 excavations of El Quemado recorded by Vaughan *et al*. (2018). Instead of real time kinematic mode (RTK), it is likely that post-processed kinematic mode (PPK) will be the setup of choice for recording work at Pacbitun moving forward, given the multiple years of challenges experienced with RTK-GPS underneath dense forest canopy and through solid stone architecture. PPK-GPS utilises the same rover and base station setup as RTK without the necessity of the real time communication between the rover and base station. Both the Trimble and Emlid GPS rover and base pairs support PPK in addition to RTK. However, the difficulty in achieving a usable GPS fix under the forest canopy will continue to be a challenge at Pacbitun, regardless of the processing done on acquired positional data.

Backup scalar documentation, relying on the measurement of known features visible within produced models correlated with measurements made by hand with tape measures, was used instead to provide scaling for all but one of the models produced thus far at Pacbitun. This method continues to have the advantage of simplicity and reliability, at the expense of absolute accuracy and geo-referencing. The authors of this chapter propose that in the future a pair of simple scale bars of minimum 1 m length with 10 cm segments be hung on lines at right angles to one another and levelled using a line level, with the tip of one of the scale bars placed facing due north to provide an integrated north arrow. A single RTK, PPK, or even uncorrected GPS points taken at the intersection of the scale bars, can be used to provide some level of geographic reference, without needing absolute accuracy on every point, which has proven to be difficult to achieve with GPS based technologies underneath the jungle canopy. The scale bars will need to be visible in enough of the images that they are effectively modelled in 3D but need not be included in every single image. By utilising levelled scale bars with an integrated north arrow, the strike, dip, and orientation of the model can be preserved and need not be referenced from hand drawn maps, as is currently the case for most of the models presented in this chapter. This method would provide a middle ground between complete RTK-GPS control recently attempted by Vaughan, Cherico and Gil, and the scalar control currently used for most models, which is as limited as the legacy hand drawn paper maps used to reference the models. Multiple scale bar sites set up as discussed above can be used to provide scaling over larger areas, as well as redundant backup to the information.

Data Processing: Photo Pre-Processing

Photos acquired in JPEG produced directly by the camera have a limited use in simply providing readymade images to produce in field test models, determining lighting and photographic coverage. Photo modelling software like Agisoft Metashape cannot utilise RAW images directly. RAW images may be likened to a sort of digital photographic negative – more data is retained but further processing is required to be of use in many situations. In previous versions of this research it was not possible to utilise the full 36.3-megapixel resolution available for the image sets captured by Jeff Powis. Recent updates to Metashape have greatly increased the efficiency of the software, allowing for the use of the full resolution images in the creation of models. The open source 'digital darkroom' software package RawTherapee is used for image pre-processing. White Balance colour correction is applied at this stage to the RAW images. The images are exported at their full native resolution with the standard RAW processing settings in RawTherapee, with only the white balance colour corrections applied. Previously, the choice of resolution downscaling was made during the image pre-processing phase.

Regarding colour correction, in the future, a custom colour profile could be produced for each model using a colour checking plate like the X-Rite passport. This would allow for compensation in the RAW image pre-processing phase to compensate for the colour cast differences identified by Spenard *et al*. (2018) in their previous attempts to unify multiple seasons of excavation. By calibrating the colour for each model individually, the colour differences can be minimised, and colour cast by environmental objects such as protective tarp coverings can be compensated for. Such colour casting cannot currently be mitigated by white balancing alone.

One advantage of the Open Source package RawTherapee is that, in the event there are questions about the processing done at this phase, the software and underlying algorithms performing the transformation from RAW to JPEG can be inspected or altered by knowledgeable parties. RawTherapee also has an option to export a settings file along with the JPEG output, providing a processing record for future researchers as to what specific operations have taken place to create a given JPEG, aiding in archiving of the photographic data. JPEG images produced directly by a digital camera have no such record, and it is not possible to modify or inspect the conversion taking place within camera hardware from RAW to JPEG. For this reason, JPEG images collected directly from digital cameras should not be used on their own for photographic modelling without saving the RAW data from the camera as well for future use.

Data Processing: Modelling Software Processing

Once suitable images have been produced from RAW source files, the workflow shifts from pre-processing to model processing. For the purposes of this chapter, most model processing took place in Agisoft Metashape, except for the drone-based model of Plaza A, produced in Zephyr 3DFlow. For this chapter, the workflow within Metashape has four primary phases. The phases are: align photos; build dense cloud; build mesh; and build texture. Agisoft also allows for different quality presentations within the software, typically to reduce processing time at the cost of model fidelity. The settings available range from 'Ultra-High' to 'Low' in most of the workflow steps. Changing this setting in Metashape results in simple input scaling – 'Low' uses images at ⅛ their nominal resolution. 'Medium' uses them at ¼, 'High' uses them at ½ resolution and 'Ultra-High/Highest' uses the original images. For the purposes of this chapter 'Ultra-High' or 'Highest' is always used, in order to use the full resolution of each image. Previously, resolution control was achieved by pre-processing the JPEG output to a desired lower resolution, while still using Agisoft Metashape in Ultra-High mode, only with the lower resolution source JPEG images. This allows for finer control of the input resolution than is possible via the quality selection options in Metashape.

Aligning photos is by far the most critical phase of the entire operation in Metashape. This phase compares pairs of photographs iteratively for points of reference, extracts the reference points and then creates a sparse 3D cloud of the points identified along with the estimated location for each camera used. The options available to the user when executing this phase are the quality of the images used ('Low' through 'Highest' as discussed above) key point limits and tie point limits. These can be used to restrict the total number of points generated as well as the number of points used for 3D cloud generation per image pair. Generic preselection is utilised for this step, which selects sequential pairs of images based on the order of the images in the project. The generated sparse 3D point cloud model is the basis on which all the other model building steps build out detail. A great deal of metric quality data is generated at this stage of the process, and as a result this is where most quality control operations can take place. Metashape estimates the quality of the camera and camera position with the estimate image quality tool. These metrics can be used to cull low quality images from the image set before proceeding to more computationally intensive stages. Images which have a low quality can simply be turned off, rather than removed from the model entirely if the disabled images are necessary to achieve complete coverage in some part of the model. For this study, a minimum image quality threshold of 0.75 was typically used.

The other component of quality control that should be performed after image alignment is complete is the selection and removal of low-quality control points using the gradual selection tool. This tool allows the user to select points based on several qualitative metrics. The options used in this menu are reprojection error and reconstruction uncertainty. These are metrics estimated within Metashape during the generation of points and refer to the quality of the identified control points and the reliability of their projection into 3D space. With both metrics a lower number equates to a better-quality point. The specific numbers reported relate to the resolution of the images input into the software. Therefore, the numbers reported here should not be re-used as canonical thresholds, instead attention should be paid to the proportion of the points discarded in each phase—think of this step as throwing out outlier data. For reprojection error, a threshold of greater than 0.2 was used, which usually results in around ten percent of the created points being selected. These points were then discarded from the model. For reconstruction uncertainty, a threshold of ten was used, resulting in between one and three percent of the points being discarded. Removing the lowest quality points from the model has greatly reduced the surface noise and has resulted in better quality models, especially when processing with lower resolution images.

The addition of this gradual selection and point discard step to the workflow has also greatly increased the final model fidelity in the darker areas present within some photo sets.

Following the implementation of quality control, the user can proceed to the remaining phases of the workflow—building the dense cloud, building the triangular mesh, and then building the texture for the mesh. The remaining steps in this workflow have fewer user input options. The only option for the dense cloud step is the quality of the images used in the generation of the dense cloud. The dense cloud step is analogous to the sparse cloud step, however many times more points are generated and projected into 3D space, resulting in a point cloud with millions rather than tens or hundreds of thousands of points, as is the result of the sparse cloud step. 'Ultra-High' is the option chosen for this step. For the build mesh phase of model creation, the points generated in either the dense or the sparse cloud are triangulated into a 3D mesh. The choices in this phase are primarily which point cloud to use (sparse or dense), whether to make a true 3D or a 2.5D mesh (a 3D mesh is preferred for handheld capture archaeological excavation models and the 2.5D option is for the efficient creation of large digital elevation models from drone aerial photographs), and the projected face count for the resulting mesh. For this step, 'High' is typically used when possible, however for larger models this may be reduced. This step is highly dependent on large amounts of system RAM on the host computer and may fail if too many faces are attempted with too little system RAM. Finally, a texture is created to be applied to the resulting 3D mesh. For this phase, the typical setting used for the mapping mode is the adaptive orthophoto method, and the blending mode chosen is mosaic. The texture size is typically set to 16000+, for large unit excavations, greatly increasing the detail mapped onto the 3D model with the texture creation step. This combination of settings was determined through a great deal of trial and error to provide the best balance between speed of texture creation and the preservation of detail in the model. Blending modes other than the mosaic often result in blurry details. The 'non-adaptive' orthophoto method often fails with the underside of overhanging areas, even when photographs exist of the underside of said areas, and other methods sometimes project details onto the wrong part of the generated mesh model. The texture size can be set higher than 16000. This number is simply the maximum dimension allowed for either horizontal or vertical resolution (so in this case the resulting texture can be as large as 16000 x 16000 pixels, which is the equivalent of a 256 megapixel still photograph).

Results

For the purposes of this chapter, we examine the set of models produced of excavation operations in Plaza A from 2015, 2016, and 2017, as well as the model of the 2017 excavation operation in Plaza B. These models represent some of the highest quality model data produced thus far from photogrammetric data collection at Pacbitun. These sets of models encompass the two primary post-processing methods utilised thus far for the incorporation of photogrammetric data into wider archaeological research at Pacbitun. First, we examine the model produced of Plaza B in 2017 (Figure 7.1). This model was produced from a single set of 110 images acquired by Jeff Powis at the end of the summer field season in 2017. The model is of extremely high quality, and the lighting present in the photographs acquired represents nearly ideal lighting conditions. The model was acquired on a cloudy morning, with project staff holding up a tarp to block the small amount of raking sunlight present early in the day. This soft, even lighting results in no harsh shadows or significantly brighter areas. Figure 7.2 is an example of the typical current use of photogrammetric modelling data to date at Pacbitun—this figure shows the traditional vector drawing plan (plan view courtesy George J. Micheletti) as

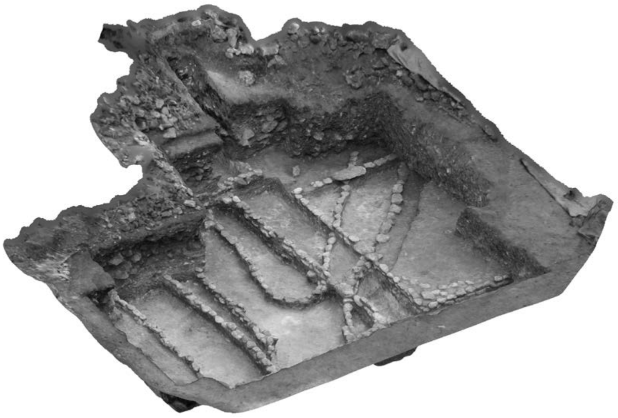


Figure 7.1. Perspective view (facing northeast) of model of Plaza B excavation from 2017 field season (Model created by Andrew J. Vaughan).

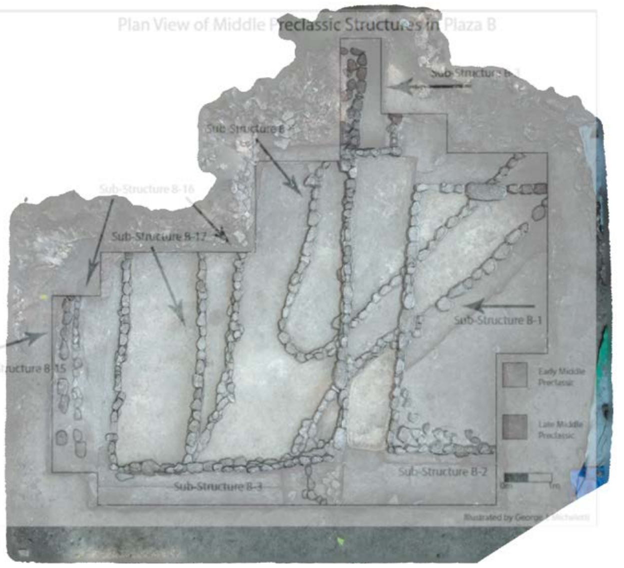


Figure 7.2. Plan view of model of Plaza B with overlay of traditional vector drawing of Plaza B (Vector Plan courtesy of George J. Micheletti).

an overlay on an orthographic plan view of the 3D model of the 2017 Plaza B excavations.

For El Quemado (see chapter three, this volume), located beneath Plaza A, it was not possible to expose the entire structure in any one field season. Instead, consecutive, iterative excavations in 2015, 2016, and 2017 were used to expose the structure in phases. Exposing the entire structure in a single season would have required an enormous effort. By iterating the exposure of the structure and recording the excavation data with photogrammetric modelling it has been possible to create a unified model, taking models from all three years and combining them to give a virtual view of the structure which was never exposed all at once. Figure 7.3 is a plan view of the model of the 2015 excavation operation in Plaza A derived from handheld photos collected by Jeff Powis. Figure 7.4, courtesy of Sheldon Skaggs, is a plan view of the model of the 2016 excavation operations in Plaza A derived from photographs acquired with a small unmanned aerial system (sUAS). Figure 7.5 is a plan view of the model of the 2017 excavation operation derived from handheld photos collected by Jeff Powis. An additional model derived from photos collected by George J. Micheletti of the Structure 3 excavation in Plaza A in 2017 was also incorporated into the unified model. The four models were combined through manual alignment in the open source software package Cloud Compare and then trimmed to prioritise details of the structure known as El Quemado. The resulting unified model is pictured in Figures 7.6, 7.7, 7.8, 7.9, and 7.10.

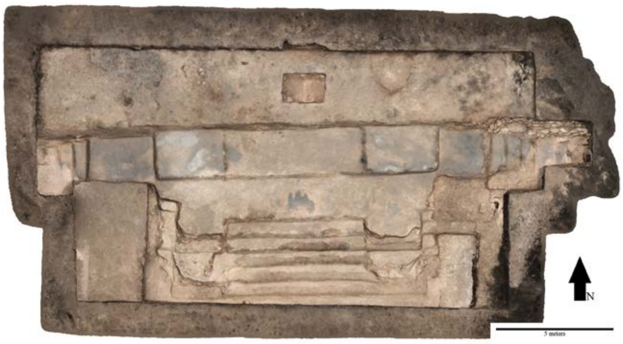


Figure 7.3. Plan view of model of Plaza A (El Quemado) excavation from 2015 field season (Model created by Andrew J. Vaughan).

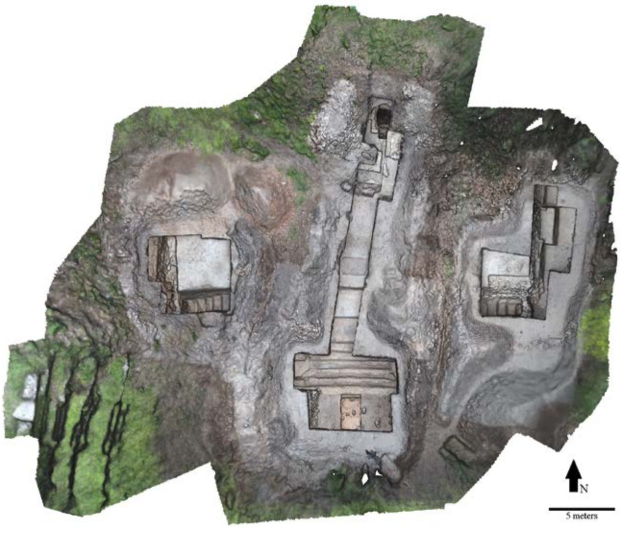


Figure 7.4. Plan view of model of Plaza A (El Quemado) excavation from 2016 field season (Model courtesy of Sheldon Skaggs).

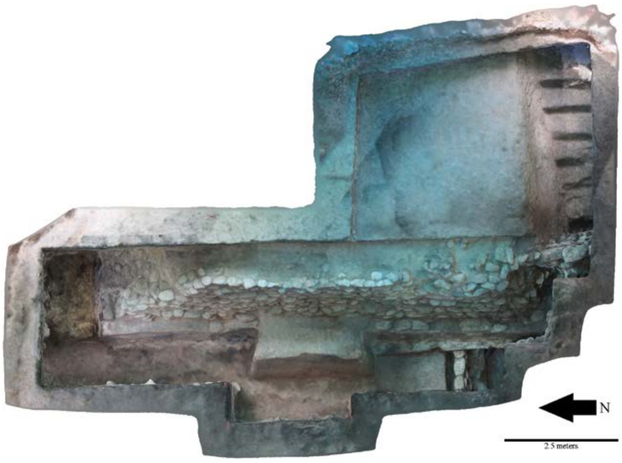


Figure 7.5. Plan view of model of Plaza A (El Quemado) excavation from 2017 field season (Model created by Andrew J. Vaughan).

Archiving Photogrammetric Data

In the archiving of photogrammetric data, it is critical that not only the final models but the source photographs, preferably in RAW format, be preserved. The rapid pace of development of the software used to produce photogrammetric models means that by archiving the RAW photographic data a model can be recreated at any time at maximum quality whenever changes to the software are likely to enhance the resulting model. Other researchers can also recreate models for themselves using different processing parameters if desired. The 3D models should be archived along with a document of some sort detailing the processing steps and software choices used in the production of said model. While the work at Pacbitun does not use the Digital Lab Notebook suggested by the Cultural Heritage Imaging (CHI) Institute (Mudge and Schroer 2018), these recommendations of best practice are in line with their recommendations for the comprehensive archiving and ‘future-proofing’ of 3D photogrammetric data. Thus, an archive of photogrammetry data should include the RAW photographs, a document noting processing into JPEG, the processed JPEG images, a document noting the processing into a 3D model and the resulting model file itself. The spatial data, whether scalar data based on known features or the GIS shapefile used to correlate the model should also be saved separate from the model file itself, though the model should be saved in its final, scaled and referenced format. By archiving photogrammetry data in this way, issues with future

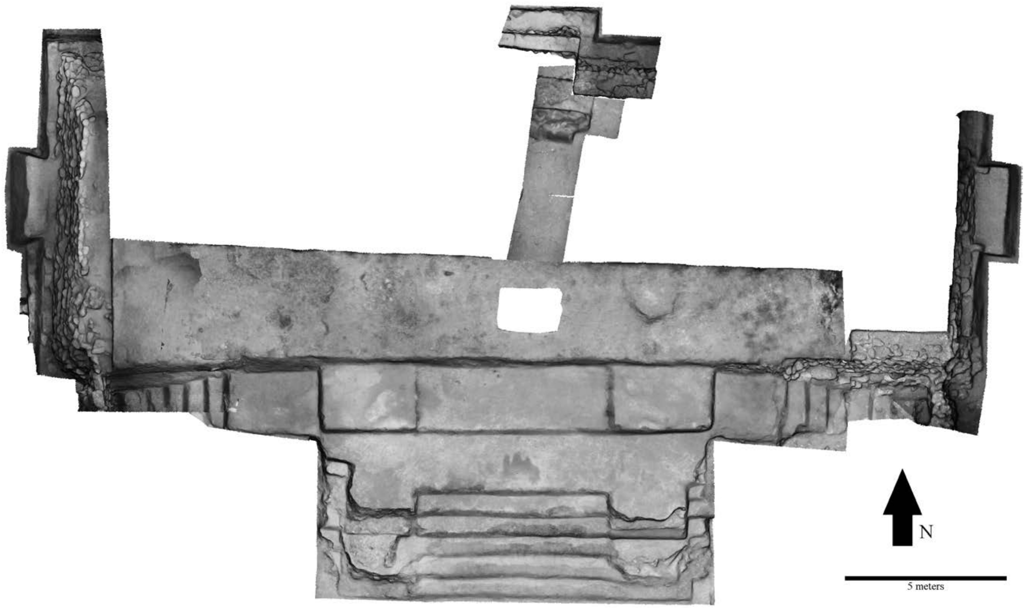


Figure 7.6. Plan view of unified model of El Quemado excavations from 2015, 2016 and 2017 field seasons (2016 model courtesy of Sheldon Skaggs).

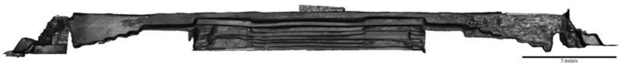


Figure 7.7. Profile view (south profile, facing north) of unified model of El Quemado excavations from 2015, 2016 and 2017 field seasons (2016 model courtesy of Sheldon Skaggs).

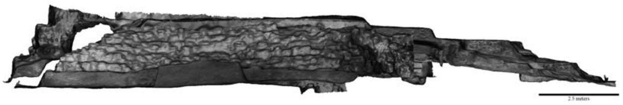


Figure 7.8. Profile view (west profile, facing east) of unified model of El Quemado excavations from 2015, 2016 and 2017 field seasons (2016 model courtesy of Sheldon Skaggs).

changes in file format readability and interoperability can also be mitigated.

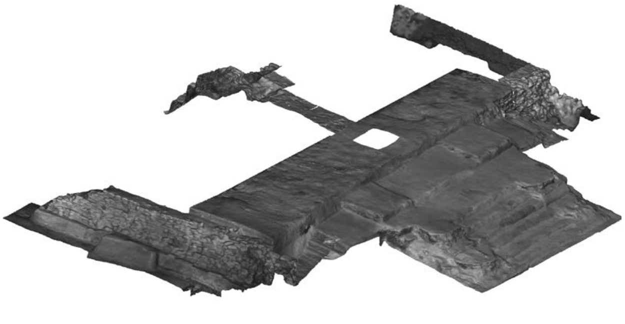


Figure 7.9. Perspective view (facing northeast) of unified model of El Quemado excavations from 2015, 2016 and 2017 field seasons (2016 model courtesy of Sheldon Skaggs).

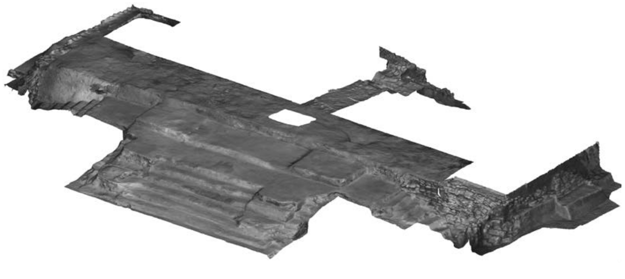


Figure 7.10. Perspective view (facing northwest) of unified model of El Quemado excavations from 2015, 2016 and 2017 field seasons (2016 model courtesy of Sheldon Skaggs).

Conclusions

This chapter represents the beginning of scientific photogrammetry at Pacbitun and is by no means to be treated as a manual to be followed rote in the future. By iteratively addressing the issues presented in the field with the collection of detailed 3D data, the challenges in implementing this method in the high-pressure and remote setting of central Belize have been addressed and overcome. It is the sincere hope of the authors of this chapter that future photogrammetric recording at Pacbitun will continue this tradition of iterative implementation to improve on and surpass the work reported on here. By developing methods to maintain interpretive consistency with extant plan and profile representations, the strengths of photogrammetry, particularly the level of detail preserved in the models, can be used to supplement rather than replace the traditional representation and recording methods already in use at Pacbitun and across central Belize. The density of data recorded in photogrammetric models provides architecturally focused excavations a means of preserving fragile exposed architectural features in an excavated state in perpetuity. The immersive and incredibly detailed nature of this data allows for an investigator to virtually re-examine past excavations as though the long closed and back-filled units are exposed in front of them once again. By ensuring spatial control and producing mapping grade models, the data can be more easily correlated with surface features crucial for understanding the development of the palimpsest that can result over hundreds or thousands of years of development which have taken place at some sites.

Acknowledgements

We would like to thank the Institute of Archaeology of Belize for allowing us to conduct archaeological investigations at Pacbitun during the 2015, 2016, and 2017 summer field seasons. We would like to extend a special thanks to the Alphawood Foundation for providing financial support for our work. We would also like to thank everyone on the field crew, especially all the local excavators, involved in excavating the units modelled for the 2015, 2016 and 2017 field seasons. There would be nothing at all to 3D model without the hot, dirty and often tedious work of excavation. We would like to also thank Dr. Terry Powis for the opportunity to test these ideas and to continue this work, as well as Dr. Sheldon Skaggs for his assistance with the 2016 drone models, and George J. Micheletti for his personal support in encouraging the resumption of this project following the initial 2015 efforts.

8

Music, Performance, Rituals, and Ceramic Music Instrument Production at Pacbitun, Belize

Kong F. Cheong

Music-making is a universal feature of humankind (Mithen 2006:1). Banging two sticks together to make rhythmic sound is an important aspect of humanity because creating any sort of music together encourages cooperation and social bonding (Mithen 2006:208; see also McNeill 1995). Ancient cultures in the Americas used music for both religious and social reasons and most probably the music was reinforced with vocal sounds or dancing (Olsen 2007:13). Musical instruments or sound-producing artefacts, especially the ones made from non-perishable fired clay, excavated from Pacbitun are well known. The Pacbitun assemblage is renowned for its quantity, variety, and most importantly, its provenience from sealed and documented contexts. Petrographic analysis along with the production sequence indicate that most of the instruments were locally made. The recovery of these sound producers from mostly female burials offer an opportunity to discuss the gendered production of music as well as the public versus domestic domains of the production. Hence, Pacbitun offers a unique case in the analysis of the Maya soundscape.

Musical Instruments from the Maya Region

Musical instruments or sound producers have been excavated throughout the Maya region. A survey of reported musical instruments found in the Maya region confirms that among the various types recovered from archaeological contexts ocarina and whistles (vessel flutes) are the most common, followed by tubular duct flutes, drums, and bells, and rarely the occurrence of vessel rattles and composite type instrument (Table 8.1). The earliest Maya musical instrument known in the archaeological record is the ceramic vessel flute, which has been excavated from such sites as Baking Pot, Blackman Eddy, and Cuello, all dating to the Middle Preclassic period (Audet 2006; Benton 2010; Hammond *et al*. 1995). There is an increase in both quantity and quality in subsequent periods leading up to Spanish Colonial rule. However, the majority of ceramic vessel flutes are derived from the Late Coc (Late Classic period, AD 700-800) and Tzib (Terminal Classic period, AD 800-900) phases (see Table 1.1, this volume) at sites such as Aguateca, Altar de Sacrificios, Calakmul, Cerro Palenque, Jaina Island, Lubaantun, and Motul de San Jose, with hundreds of specimens recovered from each of these sites (Halperin 2012; Hammond 1972a, 1972b; Inomata *et al*. 2001, 2002; Inomata and Triadan 2010; Joyce 1933; Joyce *et al*. 1927; Lopiparo 2003; Lopiparo and Hendon 2009; Marti 1968; Rands and Rands 1965; Stockli 2007; Triadan 2006, 2007; Willey 1972; Zalaquett-Rock *et al*. 2019; Zalaquett-Rock and Ortiz 2018). There is no doubt that wind instruments made from perishable materials also existed alongside fired clay versions, but these did not preserve well in the wet and humid environment of Mesoamerica. It is conceivable that musical instruments made from perishable materials were first used as far back as the Archaic period.

Although almost all ancient Maya sites yielded ceramic vessel flutes, not all of them come from similar contexts. The majority were found in various midden deposit contexts, while others were recovered from burials and, in very rare cases, from on-floor assemblages and ritual deposits. Midden deposits such as construction fill, household midden, and midden deposits from feasting events are typically associated with elite residencies in site centres. Most of these locations are palace locales (Inomata *et al*. 2001, 2009), main ceremonial plazas (Healy 1988; Healy *et al*. 2008), and epicentre (elite) residential groups (Cheong *et al*. 2014a, 2014b; Eppich 2009; Halperin 2012).

Ceramic drums, rattles, tubular duct flutes, whistling jars, bone flutes, bone raspers, metal and ceramic bells, and many other kinds of sound producers recovered from burials are not uncommon (see Audet 2006; Chase and Chase 1987:41; Folan 1969; Healy 1988; Healy *et al*. 2008; Kidder 1945; Pina-Chan 1968, 2001; Rands and Rands 1965; Shook 1947; Woodbury and Trik 1953). However, ceramic vessel flutes are most often recovered from midden deposits (Halperin 2012; Nielsen and Helmke 2015) and only in some cases have they been recovered from burials (see Cheong *et al*. 2014a, 2014b; Chase and Chase 1987; Healy 1988; McVicker 2012; Pendergast 1990; Pina-Chan 1968, 2001). It has been suggested that the mortuary ceremonies of the Maya elite typically involved processions that were accompanied with musicians playing various musical instruments and perhaps some of these were then subsequently interred with the deceased (Healy 1988; Healy *et al*. 2008; Keck 2017).

A survey of the literature (Table 8.1) indicates that a disproportionate number of musical instruments were recovered in contexts associated with the elite. However, this is perhaps because the majority of the excavations were concentrated within the central precinct of each site where the elite congregated instead of the hinterlands where

Table 8.1. Distribution of ancient ceramic musical instruments in the Maya subarea.

Site	Location	Whistle	Ocarina	Flute	Rattle	Drum	Bell	Other	Comments	References
Pacbitun	Belize Valley	8	15	5	2	1		2	All Late Coc and Tzib phases, others are hybrid flute and rattle; flutes were globular; burials	Cheong 2011, 2012a, 2012b, 2013; Cheong *et al*. 2011, 2013; Healy 1988; Healy *et al*. 2008
Barton Ramie	Belize Valley					2			Late Classic; monochrome lamp glass drum; 30 cm pedestal-vase drum height	Hammond 1972a
Baking Pot	Belize Valley			2					Late Classic; burial; two four-barrel flute	Audet 2006
Blackman Eddy	Belize Valley		11						Middle Preclassic to Terminal Preclassic	Benton 2010
Cahal Pech	Belize Valley	3	25						Middle Preclassic to Terminal Preclassic	Benton 2010; Pendergast and Graham 1981
Xunantunich	Belize Valley			1		1			Late Classic to Postclassic; flute from burial; 18.4 cm pedestal-vase drum height	Hammond 1972a; Pendergast and Graham 1981
Altun Ha	Belize District	1	3			3			Late to Terminal Classic; drum with applique humanoid/monkey head (midden); 1 ocarina (burial)	Hammond 1972a; Pendergast 1990
Caracol	Vaca Plateau		1	1					Late Classic; three chambered ocarina; pregnant monkey flute; burial	Chase and Chase 1987
Cerros	Chetumal Bay		1						Late Preclassic; burial	Garber 1989
Cuello	Orange Walk District		1						Middle Preclassic; 3 note humanoid ocarina	Hammond *et al*. 1995
Lubaantun	Toledo District	250+		5		1			Late Classic; polychrome drum	Hammond 1972a, 1972b; Joyce 1933; Joyce *et al*. 1927
Stingray Lagoon	Toledo District	1	1						Late to Terminal Classic	Bourg 2005; McKillop 1995
San Jose	Cayo District	8	1			2			Late Classic; 15.6 cm pedestal-vase drum height	Hammond 1972a; Thompson 1939
Dzibilchaltun	Yucatan	3	4	4					Late Classic; burial	Folan 1969; Taschek 1994
Jaina Island	Campeche Gulf Coast	200+		1		1			Late Classic; seven note flute; 60cm drum height; burials	Hammond 1972b; Marti 1968; Rands and Rands 1965
Lagartero	Chiapas	6							Late Classic	Ekholm 1979
Palenque	Chiapas	1							Classic	Rands and Rands 1965
Cerro Palenque	Ulúa River	150	2						Ocarinas and whistle (some in ritual deposit)	Lopiparo 2003; Lopiparo and Hendon 2009
Altar de Sacrificios	Usumacinta River	273	83	26	2	1			Early to Late Classic; double pedestal vase drum; three monkey effigy flutes (Structure A-1); two conjoined flutes	Hammond 1972a; Willey 1972
Piedras Negras	Usumacinta River	1				1			Late Classic	Hammond 1972a; Rands and Rands 1965
Aguateca	Petexbatun	379		17		15	5		Late Classic; coati or monkey effigy flute; drum (palace floor); dead baby jaguars pottery bells (elite residence); pedestal-vase drum	Inomata *et al*. 2001, 2002; Inomata and Triadan 2009; Stockli 2007; Triadan 2006, 2007
Motul de San Jose	Peten basin	162	1464	33					Late to Terminal Classic; tally from Motul de San Jose, Akte, Chachaklu'um, Trinidad de Nosotros, Buenavista and Chakokot.	Halperin 2012

Nakum	Peten basin					1			Late Classic	Hammond 1972a
Tikal	Peten basin	1	1			17			Late Preclassic to Terminal Classic; burial	Halperin 2007; Moholy-Nagy 2003
El Peru-Waka	Peten basin					1			Late Classic; elite compound; feasting event	Eppich 2009
Uaxactun	Peten basin		1			8			Late Classic; polychrome pedestal-vase drum	Hammond 1972a; Rands and Rands 1965
Yalloch	Peten basin					1			Late Classic	Hammond 1972a
El Paraiso	Quezaltenango	1		1		3	9		Late Classic to Postclassic; burial	Shook 1947
Salama	Baja Verapaz			1					Late Classic; effigy flute	Hammond 1972b
Alta Verapaz	Guatemalan Highlands	2							Late Classic	Kidder and Chinchilla 1959
Cahabon	Guatemalan Highlands	2							Late Classic?	Danien 2009
Chajcar	Guatemalan Highlands				2				Late Classic	Rands and Rands 1965
Chama	Guatemalan Highlands	2							Late Classis	Danien 2009; Kidder and Chinchilla 1959
Chipal	Guatemalan Highlands	2							Late Classic	Danien 2009; Kidder and Chinchilla 1959
Kaminaljuyu	Guatemalan Highlands							1	Early Classic; other is a whistling jar; burial	Kidder 1945
Nebaj	Guatemalan Highlands	1				1			Late Classic; bulbous body drum	Hammond 1972a; Kidder and Chinchilla 1959
Roknima	Guatemalan Highlands	4							Late Classic	Danien 2009; Kidder and Chinchilla 1959
Zaculeu	Guatemalan Highlands		3						Early Classic to Early Postclassic	Woodbury and Trik 1953

commoners would have lived. However, it is also worth noting that musical instruments or sound producers are important accoutrements in ritual practices and typically these rituals are performed by ritual specialists that are often dominated by the elites themselves (Sears 2017). Thus, the skewed distribution of musical instruments among the ancient Maya may reflect excavation bias or, perhaps, the current data on the distribution of these instruments are not too far off from the original distribution in Maya society.

Pacbitun's Musical Instruments: Assemblage and Contexts

Archaeological investigations were first conducted at Pacbitun in 1984. Musical instruments were recovered in 1986 and 1987 from elite female burials in Structures 1 and 2 in Plaza A, and then in 2010 from a sub-elite female burial in the North Group on the Eastern Court, located adjacent to Plaza A. Musical instruments were later recovered from floor construction fill of Plaza A in 2014 and 2016, while the most recent discoveries are from an elite, possibly female, burial found in Court 3 in 2017.

Structures 1, 2, 3, 4, 5, and 6 encompassed a large open area that encloses Plaza A (see Figure 1.2, this volume), which is the main ceremonial plaza and focal point at Pacbitun (see chapter five, this volume). An elite burial (Burial 1-1) from Structure 1 is a Late Coc phase (see Table 1.1, this volume) cist grave of an elite adult female between 20-40 years old who was interred with a red-slipped ceramic goblet drum and a red-slipped ceramic composite tubular flute-and-rattle instrument measuring 16.8 cm long (Figure 8.1; Cheong *et al*. 2014a; Healy *et al*. 2008). While in Structure 2, an elite adult female burial (Burial 2-1) with ceramics dating to the Late Coc phase (see Table 1.1, this volume) was interred with 14 ceramic musical instruments, the largest assemblage from a single burial at Pacbitun. They consist of one blue painted, composite ceramic tubular flute-and-rattle instrument, five ceramic tubular air-spring flutes (Figure 8.2) and an assortment of eight anthropomorphic (Figure 8.3) and zoomorphic effigy ceramic vessel flutes (ocarinas) (Cheong *et al*. 2014a, 2014b; Healy 1988; Healy *et al*. 2008).

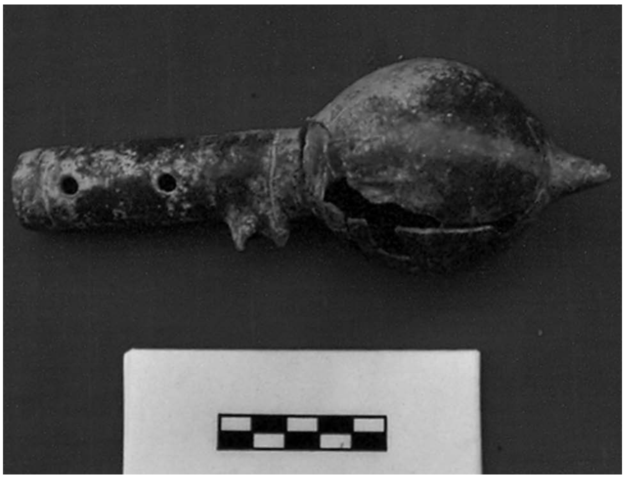


Figure 8.1. Photograph of red-slipped ceramic tubular flute-and-rattle instrument from Burial 1-1. Photograph by Paul F. Healy.

The Eastern Court is a plaza located directly northeast of the E Group's eastern assemblage (Structures 1, 4, and 5).

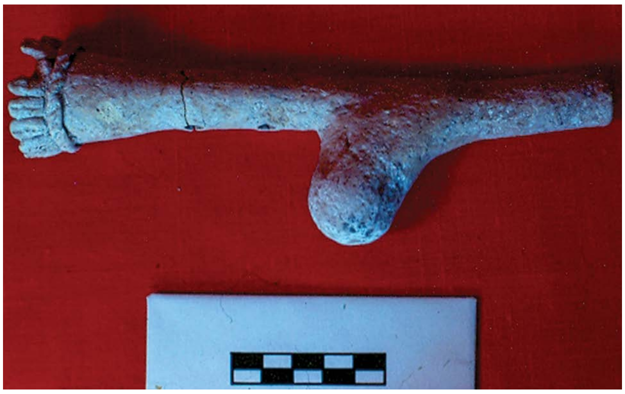


Figure 8.2. Photograph of a ceramic tubular air-spring flute from Burial 2-1. Photograph by Paul F. Healy.

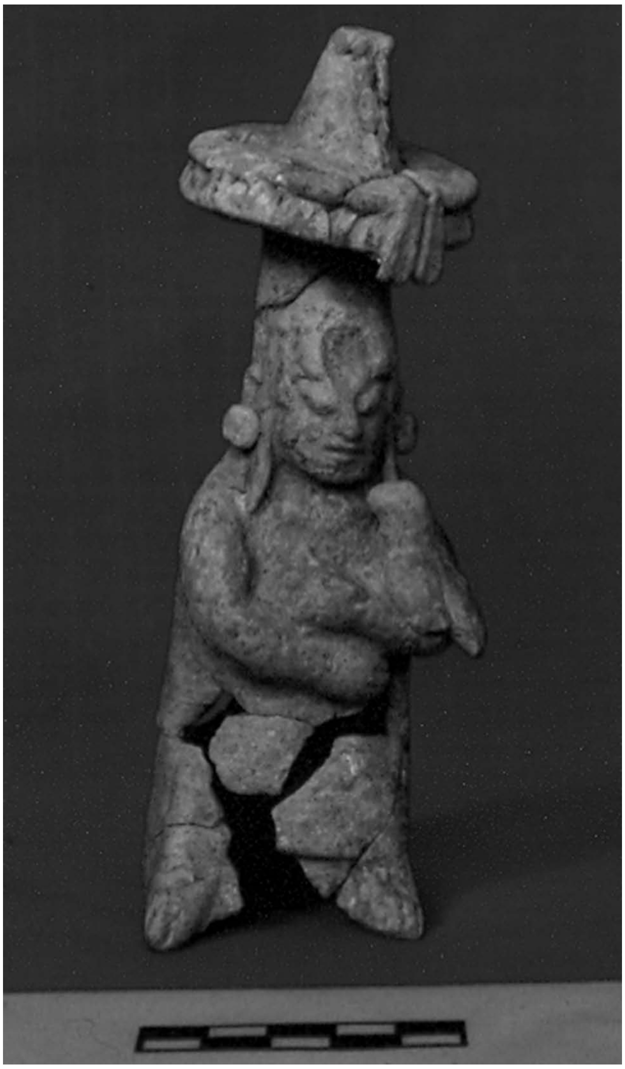


Figure 8.3. Photograph of an anthropomorphic 'Lady with pet bird' effigy vessel flute from Burial 2-1. Photograph by Paul F. Healy.

Floors of both the Eastern Court and Plaza A had similar floor construction sequences (Cheong 2013). Thus, they are similar in height and occupy the highest ground on the site with the remainder of the central precinct being 6 m lower. Structures in the Eastern Court consist of Structures 11 and 41 and the North Group which includes seven structures numbered 34-40 that form a restricted access plazuela configuration. The present configuration of the North Group dates to the Late Coc (Late Classic period, AD 700-800) and Tzib (Terminal Classic period, AD 800-900) phases (see Table 1.1, this volume). It is in this courtyard that in 2010 a burial (EC-Burial-2) of a sub-elite adult female was recovered with numerous instruments, including: one composite 'jaguar throne' vessel flute-and-rattle instrument (Figure 8.4a, c-d) that is identical to the one excavated from San Jose, Belize (Figure 8.4b; Thompson 1939:212); 11 ceramic vessel flutes (ocarinas), of which 8 are identical mould-made of a seated man (Figure 8.5); a duct whistle depicting an individual wearing a quetzal feathers headdress and performing auto-sacrifice (Figure 8.6); and two anthropomorphic effigy vessel flutes with one depicting a man wearing a long robe and a cloth headdress, while the other depicts a 'grotesque figure' with a fat face, deep set eyes, and bared upper front teeth that give it a ferocious appearance (Figure 8.7a-d; Cheong 2013; Cheong *et al*. 2014a, 2014b).

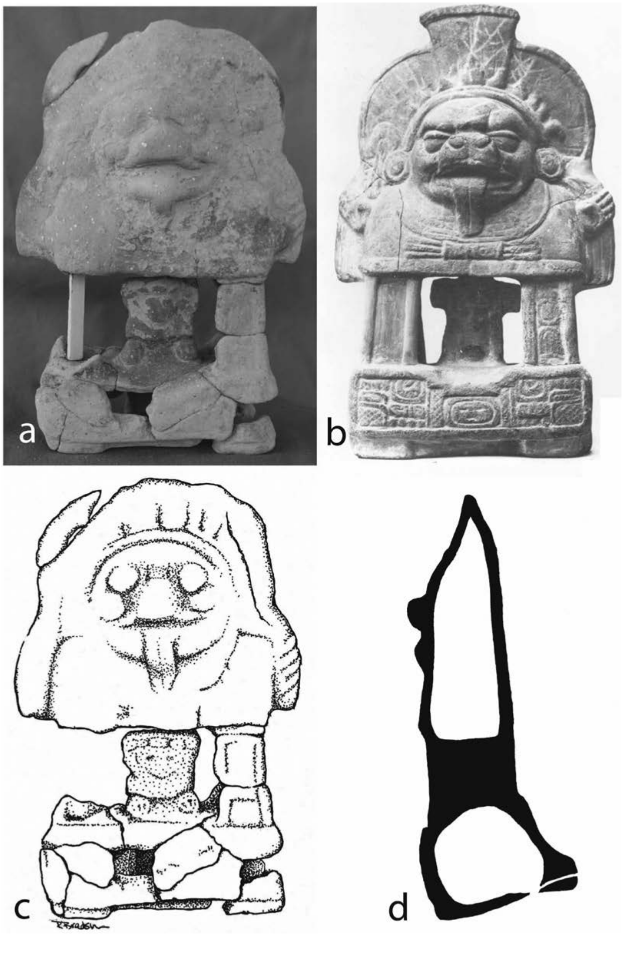


Figure 8.4. Composite 'jaguar throne' vessel flute-and-rattle instrument: A, C-D) Pacbitun EC-Burial-2 specimen; B) San Jose specimen (archival photograph from the Institute of Archaeology Belize). Photograph by Kong F. Cheong and illustration by Rebecca Bradshaw.

In 2014, a blowing horn or trumpet of a large gastropod commonly known as a Flame Helmet (*Cassis flammea*) was recovered from a Terminal Classic Tzib phase cache, designated as Cache 1, located from in front of Stela 2 on the southwest side of Plaza A (Micheletti *et al*. 2015). Subsequent excavations of Plaza A's Late Classic period plaza floors also produced a bird effigy rattle (Figure 8.8), and a ninth identical seated man ocarina from the same series (Figure 8.5) found in EC-Burial-2.

The most recent recovery of musical instruments from Pacbitun was from a cache (Cache 1) found on top of the capstones of Burial CT3-1, likely of an elite adult female. The cache included a badly damaged ceramic anthropomorphic effigy vessel flute, painted with Maya blue and depicting an individual with a headdress (Figure 8.9), as well as a ceramic chubby head effigy rattle (Figure 8.10; see chapter six, this volume; Skaggs and Cherico 2018:28, 31). Found in the layer of topsoil covering Burial CT3-1, was an anthropomorphic effigy, possibly a vessel flute, depicting the head of a monkey with large ear flares (Figure 8.11; see chapter six, this volume). Ceramics from this layer dates to the Tzib phase Terminal Classic period (AD 800-900). A similar Terminal Classic period anthropomorphic monkey head was excavated from a post-abandonment ritual deposit on Structure B-1 at the Belize Valley site of Blackman Eddy (Benton 2010:65-67, Figure 41).

As mentioned earlier, ceramic musical instruments from the Maya region are common and they are excavated from a wide range of contexts. Although Rands and Rands (1965) noted that burials with ceramic figurines (including whistles and ocarinas) are few and far between, excavations at various sites in the last few decades have certainly proven that it is not that uncommon, especially at Pacbitun. Pacbitun is significant for its assemblage of musical instruments and its variety (Sears 2017:234-235). In addition, there is a pattern of elite female burials accompanied with musical instruments at Pacbitun, particularly vessel flutes. This pattern supports Stockli (2007) and Triadan's (2007, 2014) interpretation that vessel flutes are typically associated with elite women and domestic activities.

Made in Pacbitun

Essential to the understanding of the wider socioeconomic significance of the musical instrument assemblage from Pacbitun is knowledge of the source(s) of the individual pieces. More specifically, where they were made (i.e., local or nonlocal) and were they all made in the same location. This information provides important insight into a range of activities and practices relating to the production and geographic movement of ceramic instruments, as well as their perceived economic value as material goods. Such goods must be acquired from knowledgeable craftspeople

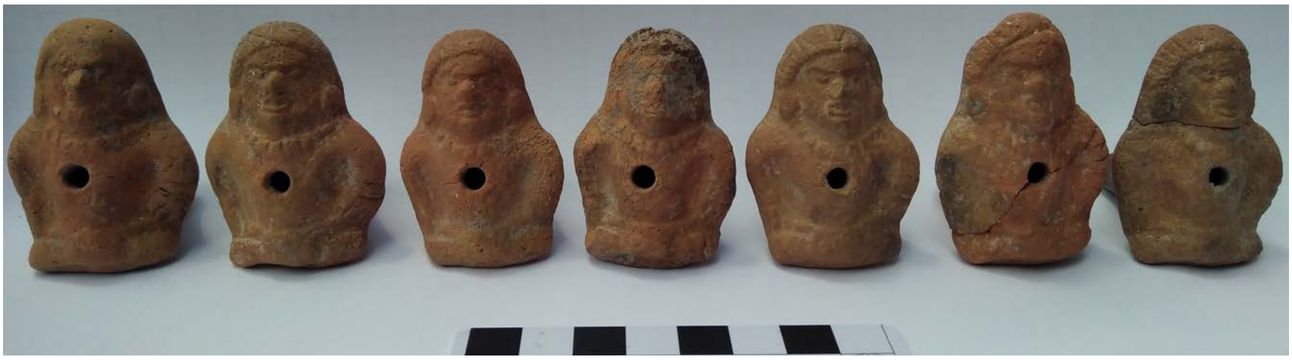


Figure 8.5. Photograph of seven of the set of eight seated man vessel flutes from EC-Burial-2. Photograph by Kong F. Cheong.

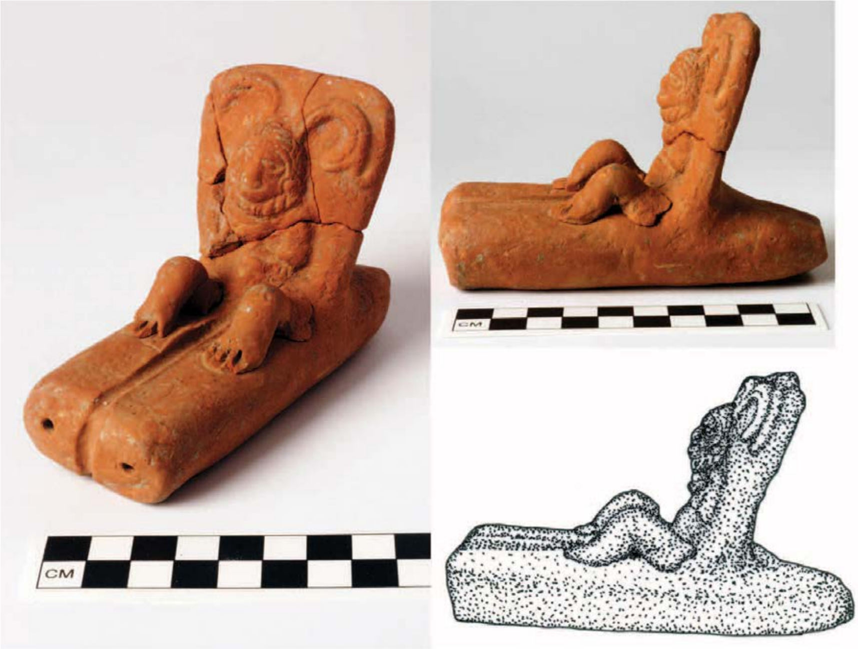


Figure 8.6. A ceramic duct whistle of an individual wearing a quetzal feather headdress performing auto-sacrifice from EC-Burial-2. Photographs by Jeff Powis, Restless Pictures and illustration by Jan Butler (Courtesy of Ronald L. Bishop and Erin L. Sears).

who use raw materials that can often be sourced to physical localities on the geological landscape (either broad or specific), thereby allowing archaeologists to trace their movement from an initial point of origin to their final place of deposition.

The area surrounding Pacbitun can be characterised as geologically diverse, and comprising of two distinct types of lithic formations, an intrusive batholith of igneous rock (the Mountain Pine Batholith), and an intervening thermally metamorphosed zone, each with distinctive lithologies. Pacbitun itself is situated on a Cretaceous limestone plateau, with the metasedimentary Santa Rosa Group formation which consists mainly of slate and quartzite, and Mountain Pine Ridge granitoids lying less than 10 km to the south and southeast (Bateson 1972; Bateson and Hall 1971; Cheong *et al*. 2014a:184-185; Dixon 1956; Hall and Bateson 1972; Kesler *et al*. 1974; Jackson *et al*. 1995; Shipley 1978; see also chapter fourteen and fifteen, this volume).

This combination of geological characteristics formed the local and micro-regional ‘geological baseline’ which permits the identification of ceramic bodies that were made using raw materials that were procured from different locations in the vicinity of Pacbitun. The ceramic body refers to the clay, and its naturally occurring rock and mineral inclusions, as well as material added as temper. It also enables the discrimination of ceramic bodies that are inconsistent with the geology of this local area and, hence, identification of ceramic goods that were manufactured elsewhere.

An initial comparative assessment of the paste compositional characteristics on some of the musical instruments from EC-Burial-2 was conducted using hand lenses (10x and 25x) and a hand-held illuminated microscope (x30) (Cheong *et al*. 2013). The hand-held microscopic analysis led to the discrimination of two distinct ceramic fabric types based on the compositional characteristics (the clay, rock, and mineral inclusions) and

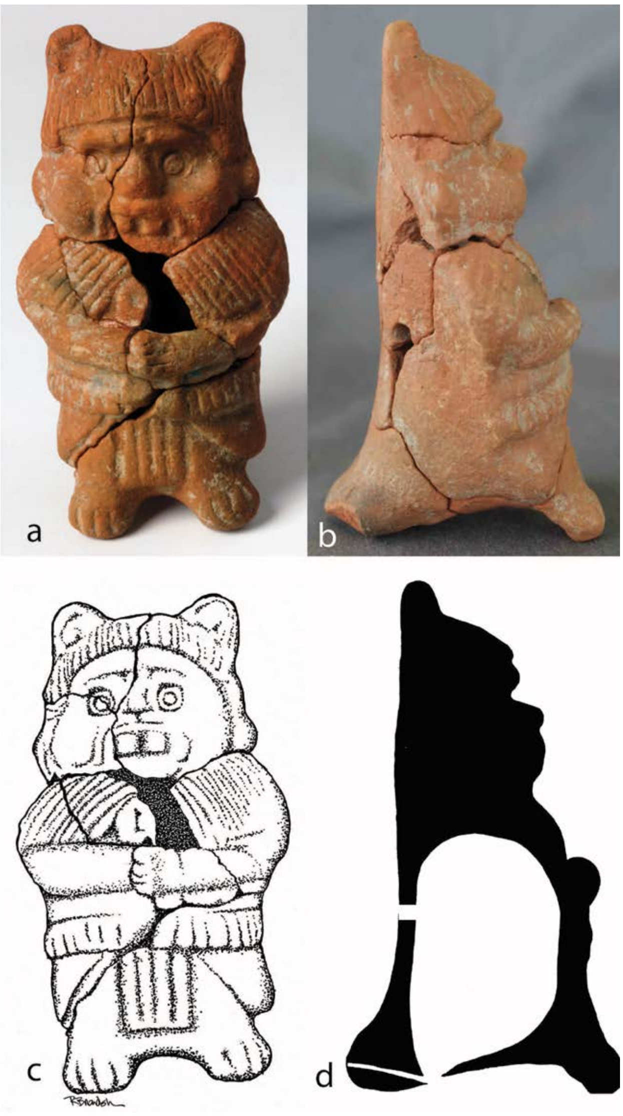


Figure 8.7. Anthropomorphic 'grotesque figure' vessel flute from EC-Burial-2. Photograph by Kong F. Cheong and illustration by Rebecca Bradshaw.

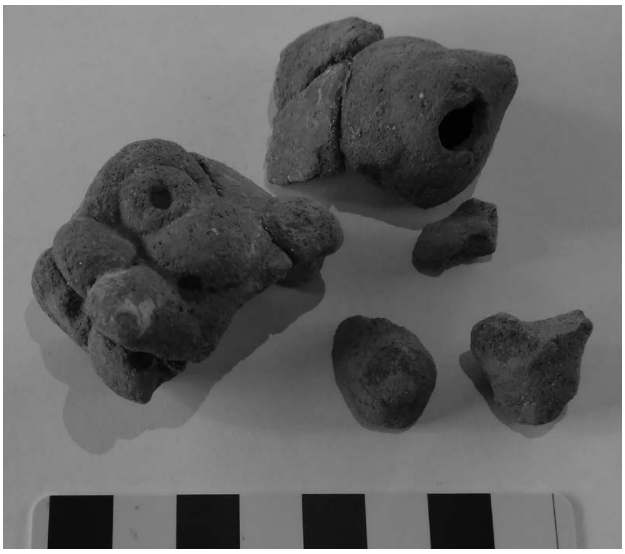


Figure 8.8. Photography of a zoomorphic bird effigy rattle from plaza construction fill in Plaza A. Photograph by Kong F. Cheong.

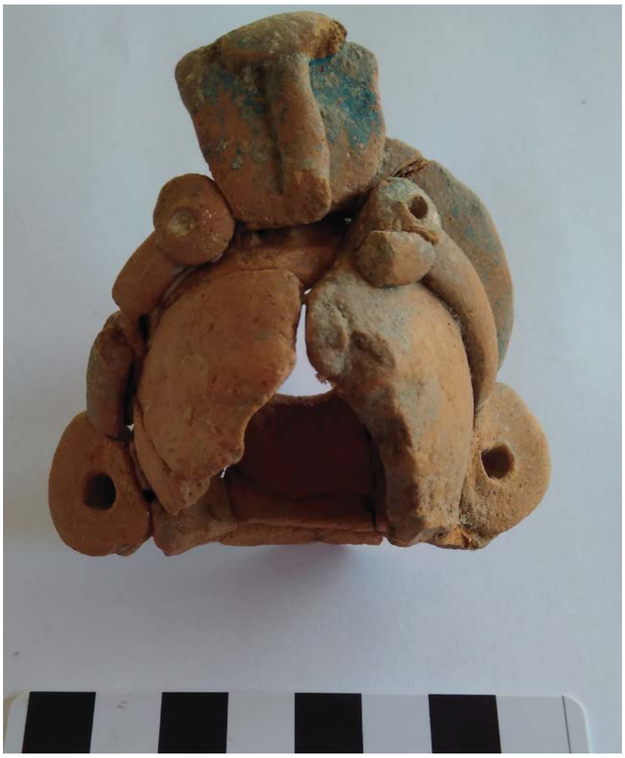


Figure 8.9. Photograph of the ceramic anthropomorphic effigy vessel flute painted Maya blue and depicting an individual with a headdress. Photograph by Kong F. Cheong.

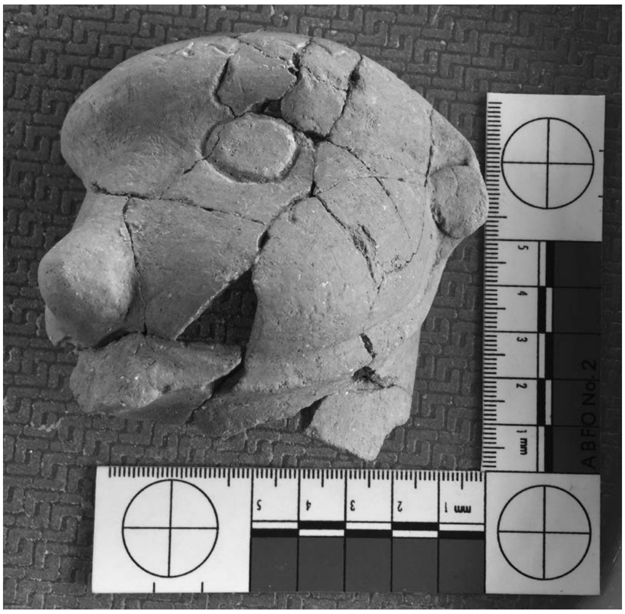


Figure 8.10. Photographs of a chubby head effigy rattle from Cache 2 of Burial CT3-1. Photograph by Nicaela Cartagena.

features of the raw material ingredients used to make them. One of these fabrics is consistent with the geology of the Pacbitun area, based on the presence of feldspar and slate, and can therefore be inferred to represent a local tradition of ceramic wind instrument manufacture. The other paste type is inconsistent with the local geology and hence can be considered to have been made elsewhere.

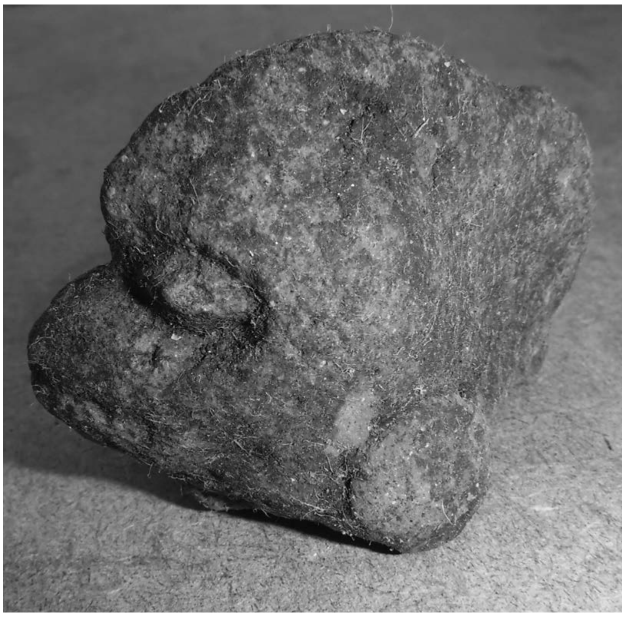


Figure 8.11. Photographs of a possible monkey head figure from Cache 2 of Burial CT3-1. Photograph by Sheldon Skaggs.

Macroscopic and in-field microscopic analysis indicate that the musical instruments made from raw materials available in the area surrounding Pacbitun include: the eight seated man vessel flutes, the 'grotesque figure' vessel flute, the duct whistle, and the anthropomorphic effigy vessel flute depicting a man wearing a long robe and a cloth headdress. Preliminary petrographic analysis by Linda Howie (see Cheong *et al*. 2013; Cheong *et al*. 2014a) was conducted on samples taken of one of the broken seated man vessel flutes (Figure 8.5) and the incomplete 'grotesque figure' ocarina (Figure 8.7). The macroscopic characteristics of the remaining instruments identified as deriving from the same production locus are consistent in all respects with the two musical instruments analysed and hence can be considered compositionally similar.

The locally produced fabric can be characterised as micaceous clay containing abundant silt-sized inclusions of muscovite and biotite, a smaller quantity of silt-sized to fine sand-sized inclusions of quartz, slate, and feldspar, and very rare fragments of finely crystalline calcite, tempered with mudstone (Cheong *et al*. 2013; Cheong 2014a:185-186). Identification of the mudstone fragments as a tempering material that was intentionally added to the clay by the potter is based on; 1) the bimodal size distribution of inclusions, with all inclusions larger than the size of fine sand being nearly exclusively mudstone; 2) the uneven distribution of the mudstone fragments across the thin sections; and 3) the contrasting angularity of the mudstone fragments to the other mineral and rock inclusions present (sub-rounded to rounded), the latter representing naturally occurring rock content of the clay component of the fabric (Cheong *et al*. 2013; Cheong 2014a:185-186).

The occurrence of slate inclusions in the clay and the mudstone temper links this fabric broadly to the Santa Rosa Group formation, which occurs to the south and southeast of the site. In addition, the slate inclusions that occur in the musical instrument fabrics are petrographically consistent with a slate slab found in the soil in the vicinity of Pacbitun and thin sectioned for direct comparison with the ceramic samples (Cheong *et al*. 2013). A broadly local provenience or origin of manufacture is also suggested by the general mineralogy of the clay component, which contains a mineral suite consistent with a Mountain Pine Ridge granitic parentage (quartz, feldspar and mica) (see chapters fourteen and fifteen, this volume), and also rare inclusions of crystalline calcite, reflecting an association with the Cretaceous carbonate rocks that underlie the Pacbitun area. The strong geological association of this fabric with both the Santa Rosa Group formation and the granitoids of the Mountain Pine Ridge batholiths, and the coincident rarity of limestone-deriving inclusions, suggests a clay source located to the south or southeast of Pacbitun near these formations, as opposed to the immediate vicinity of the site (Cheong *et al*. 2013).

The nine seated man ceramic vessel flutes (Figure 8.5) (eight from EC-Burial-2 and one from the construction fill of Plaza A's floor) are a set of identical instruments in the form of seated male figures with their mouth opened and their left arm placed on their hip while their right arm rests at their side. They have long hair and are adorned with a strand of a large beaded necklace, large round earspools, and a wristlet worn on their left arms. Each of them has a single fingerhole in their chest area and a duct and aperture in the rear bottom. They measure 5.2 cm tall and 3.9 cm wide. Some of them still have traces of blue paint. Apart from the two that have missing pieces, and two others that were mendable, the other five are complete and unbroken.

These have an impressed front with its hand-modelled resonator chamber making its back. Fortuitously, there are nine of them and their facial features show morphological characteristics of greater or lesser detail. These vessel flutes are mould-made and the differences in sharpness can be explained by the production processing in which clay is pressed into a mould to create the features of the image. The first specimen made from this mould would have the sharpest detail while the subsequent ones are less distinct due to residual clay embedded in the features of the mould. As such, these nine instruments can be placed into a production sequence from the first to the last based on their diminishing details. The production sequence, and the number of identical pieces found at the same site, indicates that they are made locally at Pacbitun. The information on production sequence complements macroscopic and petrographic analysis of the fabric to aid in determining provenience. More supporting evidence for mould-made ceramic musical instrument production at Pacbitun is that a fragment of a modified ceramic mould (for making pottery vessels) from the Late Coc and Tzib phases was excavated from Actun Xtuyul, a small rock shelter in the Pacbitun periphery (see chapter ten, this volume).

The other distinct fabric is a non-local one observed in the composite 'jaguar throne' vessel flute-and-rattle instrument (Figure 8.4a, c-d). The fabric can be 'characterised as a sandy-textured clay containing abundant angular to sub-rounded inclusions of biotite and plagioclase feldspar, and a smaller quantity of quartz, amphibole, pyroxene, and metamorphic rock fragments, tempered with crushed volcanoclastic material' (Cheong 2014b:185; see also Cheong *et al*. 2013). A portion of the volcanoclastic material present appears to represent 'fresh ash', as 'indicated by the abundance of very angular lunate- and sickle-shaped volcanic glass fragments typical of ash fall deposits' (Cheong 2014b:185; see also Cheong *et al*. 2013).

The lithology of the metamorphic rock component of this fabric, the presence of a considerable amount of amphibole and pyroxene, and the visual characteristics of the feldspar inclusions indicate a connection to a rock formation other than the Mountain Pine Ridge batholith (granitoids) (Cheong *et al*. 2013; Cheong 2014b:185; see chapters fourteen and fifteen, this volume). The abundance of the volcanoclastic component within the fabric of this composite 'jaguar throne' flute-and-rattle instrument 'suggest a source area associated with volcanic rock formations that occur in western Guatemala' (Cheong 2014b:186).

The composite 'jaguar throne' vessel flute-and-rattle instrument (Figure 8.4a, c-d) is the largest instrument in the assemblage measuring 19 cm in height and 14 cm in width. It depicts the torso of an anthropomorphic jaguar figure with a prominent snout and a large headdress. This jaguar figure is supported by two columns and hovers over a small human figure with a headdress seated on a throne or bench. It is a composite vessel flute-rattle because the bench or throne part of the instrument is the resonator box of a vessel flute with two finger holes, one on each side, and a duct and aperture in the rear bottom. The jaguar figure hovering above this seated human figure on a throne is completely hollow enclosing possible clay balls making it a rattle. Traces of blue and red pigments were identified on some fragments suggesting that the entire instrument would have been painted blue and red.

Similar 'jaguar throne' composite vessel flute-rattle instruments have been excavated from burials elsewhere at Altar de Sacrificios, Nakum, San Clemente, San Jose, Tikal, and Yaxha (Halperin 2007:284, Fig 8.19, 2014:58-59; Thompson 1939:212, Pl. 23a and c; Willey 1972: 53-53; see also Cheong *et al*. 2014a, 2014b). While others are similar in themes and motif, the one from San Jose, Belize is identical to the one from Pacbitun. This suggests that both instruments were produced at the same workshop, possibly using the same mould, since even some minor features are identical. The specimen from San Jose was also excavated from a burial and dated to San Jose IV and early San Jose V, which correlates to the Late Classic period (Thompson 1939:212). The front walls of the throne part of the instrument depict the Ajaw glyph on both the San Jose and Altar de Sacrificios specimen. While the Pacbitun specimen is too eroded to discern if it has a similar glyph, it is a good indicator of the importance of the function of this object, as the Mayan word Ajaw means lord or ruler.

When considering the wider implications of the findings of the petrographic study of the Pacbitun musical instruments, it is significant that neither the local nor non-local fabric types identified correspond with previous descriptions of musical instruments reported for other sites. For example, both of the Pacbitun fabrics are inconsistent with the descriptions of the three effigy vessel flute fabrics reported by Anna Shepard for the site of San Jose (Thompson 1939), as well as with the paste descriptions reported for the large musical instrument assemblage recovered at Lubaantun (Hammond 1975). The study of the Pacbitun instruments, therefore, has not only confirmed Pacbitun as a production locality, but has also identified an additional source of musical instruments, perhaps somewhere in western Guatemala, which is located at a considerable distance from Pacbitun. These data demonstrate that musical instruments sometimes travelled long distances during their use life, even when functional equivalents were produced close by.

Gendered Production in the Domestic and Public Domains

Musical instruments are tangible objects, with identities and cultural capitals of their own in addition to being essential in many religious and secular rituals (Doubleday 2008:3-4). Objects such as musical instruments have meanings inscribed in their forms, uses, and trajectories (Appadurai 1986:5). They are enlivened by both the human actors that encoded significance into them as well as animated objects that illuminate their human and social context (Appadurai 1986:5). The power play between humans over musical instruments are often along gender lines as gender is one of the most important parameters in human power relationships. It is through the 'agency of monopolies and taboos, one group may claim possession over an instrument to the exclusion of another' (Doubleday 2008:4). For example, Hasson von Winning (1974:56) argued that music performances in pre-Columbian West Mexican societies were monopolised by men, and a recent study of 1638 West Mexican music, culture-related objects strongly supports this hypothesis (Cheong *et al*. 2017:95-96).

Additionally, significant objects like musical instruments are themselves social agents in human culture by having a personhood with gendered meanings of their own, and 'enmeshed in a texture of social relationships' making their personhood fluid and negotiable (Doubleday 2008:4; Gell 1998:7,16-17). Some musical instruments may be more acutely or obviously gendered based on the degrees of symbolic externalisation of physical and social needs, aspirations, allegiances, and creative energies of their makers (Dawe 2005:59; Doubleday 2008:6). In other words, the activity between producers and their products creates meanings that may serve to engender both the persons and artefacts (Tilley 2002:27). Social practice and social context are also important indicators of gender in an instrument. A good example of this is the Indian bowed lute 'sarangi' where the instrument's physical body and sound are key factors in articulating cultural meaning and are typically played as accompaniment to singing courtesans. Thus, its sound has a feminine association (Qureshi 1997:4; see also Doubleday 2008:9).

Instrument makers uses gendered meanings in the designs and decorations of their creations, these can be anthropomorphic, zoomorphic, sexual symbols, symbolic designs, figurative depictions, and inscriptions (Doubleday 2008:10). Gendered characteristics can also be incorporated into an instrument by using specific materials like wood or skin from a male or a female tree or animal (Doubleday 2008:10). A producer of musical instruments not only refers to the makers of these instruments but also to the instrumental performers who activate the instruments by bringing their sounds to life, and also many others who are involved in the creation of meanings in these instruments like ritualists, religious leaders, people involved in the music industry, visual artists, novelist, poets, politicians, and the like (Doubleday 2008:7). The gist of this is that 'gendered meanings are constructed within relationships between human and musical instruments' (Doubleday 2008:3).

Through social practices, it is observed that certain instruments are associated with femininity like the Iberian square frame drums which are only played by women drummers and are linked to human fertility (Cohen 2008) or masculinity like the Acehnese rapa'i pase' drums which are bequeathed from father to son and are only played by men (Kartomi 2004). However, like the case of Pre-Columbian West Mexico, the realm of musical instruments primarily remains male-dominated up to the present because it is uncommon for gendered relationships to be egalitarian (Doubleday 2008:15). This is due partly because of social strictures about gendered division of spaces, where women are prohibited from entering the public professional artistic arenas, partly because male players have been guarding their territory and the economic benefits that they have gained, as well as maintaining the sustained and enhanced images of male authority and leadership (Doubleday 2008:17); therefore, the public use of musical instruments is the ritual enactment of male supremacy (Robertson 1989:227). In essence, male dominance over musical instruments persisted by manipulating space to be a male domain, especially public spaces, and by the 'long-entrenched pattern of male control over technology' (Doubleday 2008:18). Men also maintain exclusive control over musical instruments by storing them in male-only spaces (Doubleday 2006:127-128, 2008:18).

Spatial segregation is 'an important mechanism for exerting power' as men tend to control public spaces which includes ritual and sacred spaces by preventing the access to knowledge and resources located in these spaces (Doubleday 2008:18; Spain 1992:15-16; see also Low and Laurence-Zuniga 2003). Male dominance and control of music performance and technology knowhow are not universal in all societies. Women from the Kaluga, Kursk, Briansk, and Komi territories west of the Ural Mountains for example make and tune sets of panpipes using local plants and reeds - a recreational group activity that always occurs outdoors, in public and in nature (Doubleday 2008:19; see also Velichkina 1998).

The idea of domestic-public space is one of both a spatial metaphor (geographically separated space or nested spaces) and a functional metaphor (activities of various functionalities or social roles) (Yanagisako 1987:111; see also Lamphere 1993). Rayna Reiter (1975) for example, observed the distinct lives of women and men in a small French village in Southern France where they spatially dominated either the domestic or public domains. During the day time, the women would be out in public spaces, shopping and conducting their daily business. Essentially, they had taken over the village while the men disappeared from the public to their fields; but in the evenings when the women are hidden away in their homes cooking, the men would socialise among themselves in public places like central plazas and cafes (Reiter 1975:253, 258). The association of men with public spaces and women with domestic spaces are not clear-cut here because in Reiter's example the women basically took control of the public domain for the majority of the day while retaining full control of their domestic domain (Lamphere 1993:84). In another example, Margery Wolf (1972) observed that in the village of Peihoutien in Taiwan, the domestic and public separation was not geographic or spatial but more of a functional separation as men and women have different interests and activities (see also Lamphere 1993:85). In this patrilineal society, the women built strong relationships with their daughters as well as their sons who were not only loyal to their mothers but also to their place in this male-dominated community and, as such, the women were often able to undermine male control within the household and out in the community (Lamphere 1993:85). In both examples, they have shown that there are no clear-cut divisions between the domestic and public domains but rather women in these societies have full control of their domestic domain while men also have their public spaces as permitted. As such, the idea of domestic-public division, seemingly derived from the Victorian doctrine of separate male and female spheres Lamphere 1993:86; (Rosaldo 1980:401-402), is not applicable in most societies and cultures because the public domain is strongly related to domestic space (household). This blurring of the two spheres is obvious, especially in the production of music, as sound transcends both physically and culturally constructed spatial and functional barriers.

The Soundscape at Pacbitun

Soundscape is the totality of all sounds present in a given environment and how they interact within that particular environment (Scullin and Boyd 2014:363; see also Schafer 1977). For example, the soundscape of a weekend farmers market in a town square is the sum of all audio perceptions and could include all the sounds and noises from the busy buying and selling as well as the cries of babies, the barks of dogs, the occasional honking from nearby traffic, and perhaps a live band. The reconstruction of the soundscape of an ancient city will depend on good contextual information in the form of preservation of architecture, the clear understanding of the internal spatial arrangement of such structures at a given time period, as well as the recovery of musical instruments, as these artefacts create intentionally desired types of sound played by that culture, in that location, during that time period (Scullin and Boyd 2014:363). Along with the manipulation of the physical spaces and objects, there is also the concept of 'noise' which is the mental and social constructions of soundscape (Scullin and Boyd 2014:364). Noise, if it is wanted, is music and, if not, it is just unwanted noise (Scullin and Boyd 2014:364-365).

However, there is no way to decipher the ideal soundscape of an ancient society because people living today can never be certain about the ancient soundscape beyond the level of speculation (Olsen 2007:14). At Pacbitun, archaeological investigations have been ongoing for almost four decades, which means that Pacbitun's central precinct is well understood, with all of its 41 structures located and precisely mapped. Additionally, a sizable quantity of music instruments that were recovered date to the Late Coc (AD 700-800) and Tzib (AD 800-900) phases that corresponded to the Late Classic and Terminal Classic periods (see Table 1.1, this volume). As a result of a combination of these factors, the postulation of soundscape at Pacbitun during the Late Coc and Tzib phases is conceivable.

Some of the unbroken and functional sound artefacts from Pacbitun were analysed by recording the sound produced, using a Zoom digital recorder, and the resultant .wav files were analysed using Sibelius, a digital music synthesis programme. For example, the seated man vessel flutes (Figure 8.5) are capable of producing a note which is two octaves above middle C (Cheong *et al*. 2014b:186). While the duct whistle of the quetzal feather headdress wearing individual performing auto-sacrifice (Figure 8.6) produced a pitch which is close to a C6 [1046.50 Hz] as well as a slight difference in frequency rate between the two tubes, thus resulting in an acoustic phenomenon called 'beat' (Cheong *et al*. 2014a:130). The ancient Maya had certainly used a pentatonic scale, which are five notes to the octave. The musical instruments excavated from Pacbitun, especially the set of nine 'seated man' vessel flutes (Figure 8.5) are unlikely to be tuned to a specific pitch as it is clear that they did not form part of a tuned set (Cheong *et al*. 2014b:186). Thus, we know that the ancient Maya at Pacbitun intentionally created these musical instruments to produce a particular type of sound. In the case of these 'seated man' vessel flutes, perhaps they are a mimicry of bird chirpings, because like the Kaluli of Papua New Guinea, the rainforest of the Maya Lowlands influences and shapes the Maya understanding of sound as well as their music (Feld 1982; Scullin and Boyd 2014:363).

The production of music does not only mean the performance alone (the playing of musical instruments), but also the production of the musical instrument itself, not unlike the women panpipe players of Southern Russia. It can be inferred that because the majority of musical instruments were excavated from elite and sub-elite female burials, these instruments, especially rattles and vessel flutes (ocarinas), are feminine and thus would be played exclusively by women and perhaps children as previously suggested by Stockli (2007) and Triadan (2007, 2014). Although both Stockli and Triadan suggested that they are related to a domestic setting because of the location of where these instruments were kept in storage (and ultimately excavated), I propose that although the female burials from Pacbitun were all excavated from restricted access courtyards and plazuelas (both domestic), the nature of music is that it can be heard even from behind a hidden courtyard or above a restricted access plazeula. Sound travels and does not respect the boundaries or the restrictions of the built environment. Similar to the conclusion on the domestic-public spheres, being non-distinct, music and sound at Pacbitun, though produced in hidden restricted access courtyards and plazuelas, could still be heard in the 'public' areas of the central precinct.

Thus, the soundscape of Pacbitun would have been a mixture of not only music and sound produced during rituals, ceremonies, and processions by elite men blowing trumpets, and beating drums, but also music and sound made by the elite women using their rattles and vessel flutes in their restricted access courtyards and plazuelas, all accompanied by the noises of a busy, open air market in Plaza B as well as the noises of activities like wood chopping, children playing, and a mason's hammer busily shaping stones for construction. Atop all these layers of sound is the ever-present sounds of nature from the rainforest such as the howling from male howler monkeys, the chirping of various bird species, the rustle of leaves and corn stalks, the pesky sound of the mosquitoes, the sound of rain falling, and running water. This is the sound of a vibrant ancient Maya city.

Conclusions

Pacbitun is unique in that the long archaeological investigations of the central precinct have not only yielded a large quantity of musical instruments but also allowed researchers to map and recreate the built environment, particularly that of the Late Coc and Tzib phases where most of the musical instruments were excavated from. This facilitated the reconstruction of the soundscape during these time periods. Preliminary petrographic analysis has indicated that Pacbitun is one of the few locations in the Maya region that manufactured ceramic musical instruments and traded with various other producers. This is known due to the identification of nonlocally made musical instruments found, in some cases, in the same burial with locally made instruments. The current presentation, although preliminary, does provide a very vivid picture of the soundscape of Pacbitun. As the project research finds more and more musical instruments from this centre, more analyses can be conducted to gain a better understanding of Pacbitun and its soundscape.

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9

Writing Pacbitun into the Historic Record of the Southern Maya Lowlands

George J. Micheletti, Christophe Helmke, and Paul F. Healy

The Maya kingdoms of the Classic period grew out of successful ritual and political centralization of the institution of kingship, established by the Late Preclassic period (300 BC-AD 250). At the dawn of the Early Classic (AD 250-600), monumental architecture would continue to be an expression of wealth and authority while the royal version of ancestor veneration provided a link to the supernatural world and ultimately served as a means to divine legitimacy. What distinguishes the Early Classic from preceding periods, however, is the increasing presence of hieroglyphic texts displayed on stone monuments and portable objects, used as further means of expressing royal prerogative. Unfortunately, the narrative recorded on Early Classic monuments pick up mid-story and include no prologue, leaving any preamble to archaeological interpretation.

Nevertheless, from the growing epigraphic record of the Classic period, scholars are continuing to gain a better understanding for the historical processes and political boundaries of the southern Maya lowlands. Far from static, these boundaries were ever-changing due to the hegemonic strategies of greater kingdoms, often resulting in the subordination of provincial polities (e.g., Houston 1993; LeCount and Yaeger 2010; Martin and Grube 1994; Schele and Mathews 1991). The site of Pacbitun in Belize, like many of its neighbours of the Belize River Valley region, fell into the category of provincial polity. Each of these centres would have, at some point, played a part in the hegemonies of powerful Classic period kingdoms—particularly of Caracol and Naranjo, although even more distant courts, such as those of Tikal and Calakmul, also influenced the affairs of sites in the region. Archaeological, iconographic, and epigraphic evidence found at the Belize Valley sites of Baking Pot, Buenavista del Cayo, and Xunantunich has tied them to the kingdom of Naranjo during the Late Classic period (Helmke and Awe 2012; Helmke *et al.* 2018; Houston *et al.* 1992; LeCount and Yaeger 2010; Taschek and Ball 1992, 2004). Adding to this knowledge, the 2016 excavations at Xunantunich recovered two carved panels thought to once belong to the hieroglyphic stairway of Caracol (Helmke and Awe 2016a, 2016b). While the majority of this stairway was found at Naranjo, considered to be the spoils of victory after the defeat of Caracol in AD 680 (Martin 2017; Martin and Grube 2000), panels at Ucanal and now Xunantunich hint at their involvement in the Classic period drama detailed in the monuments of neighbouring kingdoms.

Regrettably, monuments and portable artefacts with inscriptions are far less common in the Belize Valley. For this reason, much of the historical interpretation for this region has relied heavily upon archaeological investigation and the analysis of material culture. When archaeologists at these sites do discover artefacts and monuments with epigraphic and iconographic data, the information gleaned can be used to substantiate, revise, and/or supplement the archaeological record. To date, excavations at Pacbitun have recovered painted or carved text and/or symbolic imagery on a variety of artistic media including ceramic, shell, bone, and stone objects (see chapters two and sixteen; this volume; Healy 1990b; Healy *et al.* 2014:103-104, Figure 6.4; Helmke and Awe 2012; Helmke *et al.* 2006; Helmke *et al.* 2015; Skaggs *et al.* 2017a). However, accounting for all items from each media category, the total number of artefacts is extremely small with the vast majority presenting very limited glyphic evidence. Of these, the most complete and abundant sources of information are two fragmented monuments dating to the Early Classic period (AD 300-550) (Healy 1990a, 1990b; Healy *et al.* 2004a; Helmke and Awe 2012; Skaggs *et al.* 2017a). Fortunately, the information recorded on these monuments, identified through epigraphic and iconographic analysis, offers clues as to the political state of affairs at Pacbitun and to the place and involvement of this site within the events of the southern Maya lowlands. The damaged and fragmented condition of these monuments has hindered a complete decipherment, and even still, the marring wrought on these in antiquity testify to desecration and martial actions against Pacbitun during the Classic period.

The purpose of this paper is to detail how Pacbitun's monuments, in conjunction with the archaeological record, speak of the site's involvement in the known historical conflicts, recorded in the monuments of the surrounding kingdoms in the midst of the Classic period. This chapter will demonstrate Pacbitun's Early Classic (AD 300-550) to Late Classic (AD 550-800) shift from what was likely a subservient polity to a semiautonomous one with strengthened local ties. The changes associated with this shift will first be substantiated archaeologically with a discussion of a significant, site-wide construction event that would include unique modifications to the site's E Group during the early part of the Late Classic period (AD 550-800) (see chapter five, this volume; Healy 1990a; Micheletti 2016). Next, it will be important to discuss dating and extract other evidence pertaining to Pacbitun's political situation provided by the analysis of these monuments, the most pertinent being the identification of toponymic elements of potential affiliates and an agentive phrase often used to acknowledge superiors.

Shifting our analytical focus to the physical state of the monuments, after discussing the meaning behind monument defacement and desecration, we will turn to examine the fragmented condition of Stela 6 and Altar 3. We then consider the archaeological context of destroyed and/or displaced monuments which can reveal information concerning not only the date of an event but also the fate of a defeated polity. The contextual analysis of Altar 3 appears to suggest reverential treatment throughout the Late Classic period and may even provide an explanation for the secondary context of Stela 6. Finally, correlating the data presented in this chapter with the epigraphic record of the southern lowlands has allowed us to create a timetable for determining which event(s) may have impacted these monuments. Though difficult to confidently identify with certainty, we believe the post-conflict socio-political change and autonomy generated florescence, closely resembles those occurring elsewhere in the Belize River Valley during the Late Classic period (AD 550-800), ultimately signalling an intensified relationship between Pacbitun and this region.

Pacbitun, Belize

Despite the relatively lengthy occupation (see Table 1.1), Pacbitun's size, like many of its northern neighbours of the Belize River Valley, remained comparatively modest compared to other Maya centres of the southern lowlands. However, the construction of monumental architecture in the midst of Pacbitun's Middle Preclassic period (900-300 BC)—likely tied to the site's burgeoning shell bead industry—points to an early significance (see chapter three, this volume; Hohmann 2002; Hohmann and Powis 1999; Hohmann *et al*. 2018; Powis *et al*. 2009). By the Late Preclassic period (300-100 BC), Pacbitun had buried and abandoned their old residential and ceremonial structures to adopt the new, and possibly pan-Maya ideological system evinced by the construction of their own E Group complex—a common architectural theme found throughout the southern lowlands at this time (Chase and Chase 2017). Aside from a regional deviation in the construction of the E Group, Pacbitun's epicentre saw increasing standardization and, by the Early Classic period (AD 300-550), resembled most medium-sized centres in and around the Belize Valley. However, it was this region's unique take on the E Group that helped to identify the social and political changes that Pacbitun had undergone at the beginning of the Late Classic period (AD 550-800).

A re-examination of the E Group complex and several other similarly constructed assemblages in the Belize River Valley now suggests that these complexes are actually a variant form of the E Group (see chapter five, this volume; Awe *et al*. 2017). While these assemblages have the triadic appearance of an E Group, the three buildings are not supported by a discrete sub-structural platform and each structure began as separate entities that were individually modified, resulting in an asymmetric appearance (Awe *et al*. 2017:420-428). What is more, these buildings are typically found with numerous interments suggesting that their function focused heavily on ancestor veneration (Awe *et al*. 2017:432-435). At a glance, Pacbitun's assemblage appears to share all the qualities of an Eastern Triadic Assemblage. However, a reconstruction of the Early Classic Tzul phase (AD 300-550) of Pacbitun's ceremonial assemblage clearly shows that the flanking structures were symmetrical at this time. Although the buildings that compose the eastern triad of Pacbitun's assemblage did begin as three separate entities, modifications up to this Early Classic phase were simultaneous and uniform according to Healy (1990a; Healy *et al*. 2004a:210; see also Micheletti 2016:44-68). The assemblage is also only associated with two burials up to this point, a number not uncommon for many documented E Groups, several of which receiving interments for a short duration in the Terminal Preclassic (100 BC-AD 300) and Early Classic (AD 300-550) periods (Chase and Chase 1995:100). So, whereas Pacbitun's assemblage did initially follow the Belize Valley Eastern Triadic Assemblage conventions, for whatever reason, by the Early Classic period (AD 300-550) it lacked some of the most important attributes of the local variant.

However, at some point during the early part of the Late Classic Coc phase (AD 500-800), as part of a site-wide construction event, the E Group was renovated, and the missing Eastern Triadic Assemblage attributes were added (Figure 9.1). As a result, the flanking structures then appeared as two distinct buildings resulting in a loss of symmetry. More importantly, 10 elite burials are associated with this early Coc construction phase, five of which were placed into Structure 1. A newly constructed stairblock was built to mark the location of the tomb of Burial 1-9 (BU 1-9) constructed at the base of a 5 m deep, rubble-filled shaft that had been cut through each of the earlier architectural phases (Healy *et al*. 2004b:229-233). The placement of BU 1-9 at this location appears to initiate the intensification of this assemblage's use as an ancestor shrine and reveals the privileged place of this individual over the previous interments placed within this structure. Therefore, the physical and functional alterations made to Pacbitun's E Group, considered to be ritually and politically significant to this site's community, may signal socio-political change.

The Late Classic Coc phase (AD 550-800) construction episode that transformed Pacbitun's E Group was part of an extensive, site-wide construction event that would both modify and expand the site. Continuing along the theme of unique renovations, alterations to the site's ballcourt, located to the north of Plaza A within Plaza E, incorporated a new vertical wall to the centre of the sloped playing alley and running the length of the two buildings (Healy 1992). According to Healy (1992), this addition would have

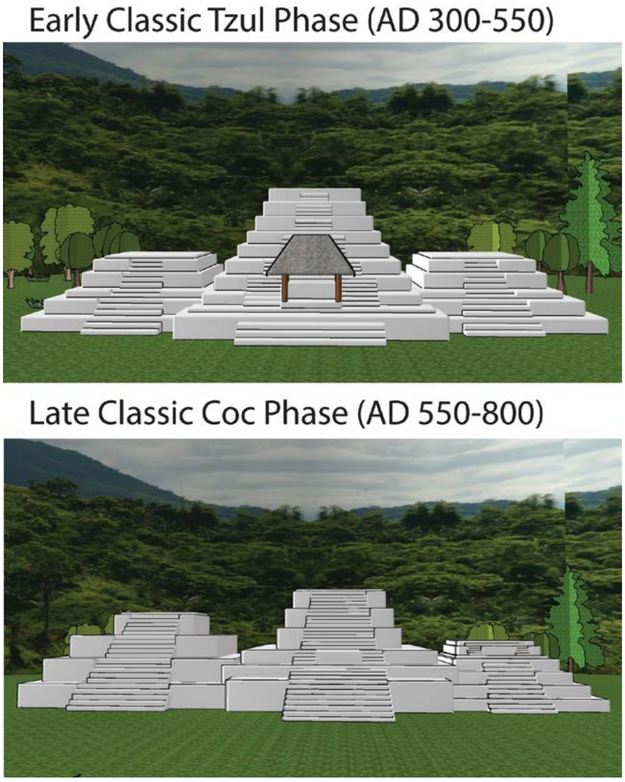
Early Classic Tzul Phase (AD 300-550)
Late Classic Coc Phase (AD 550-800)

Figure 9.1. Hypothetical reconstruction model representing the physical variations between Pacbitun's Early Classic period (AD 300-550) and Late Classic period (AD 550-800) eastern E Group component (created by George J. Micheletti in Sketchup).

'created an entirely new set of angles, and presumably game strategies, for the ball players.' Other architectural additions include the constructions of both Court 1 and Court 3 (see chapter six, this volume; Skaggs and Cherico 2018; Skaggs *et al*. 2017a), both now flanking a newly renovated Court 2 (Bill 1987). Pacbitun's causeways are also thought to be constructed at this time (see chapter thirteen, this volume; Weber 2014). Aside from the construction event, the elaborately built elite graves and the furniture found within suggest that Pacbitun was flourishing and had clearly benefitted economically from the recent social and political changes (Healy 1990a). As will be discussed, this opulence appears to have been a Late Classic trend for sites throughout the Belize River Valley.

The Late Classic transformation of Pacbitun's ceremonial assemblage from E Group to Belize Valley Eastern Triadic Assemblage seems to suggest there may have been a social divide between this site and its neighbouring centres during the Early Classic period. In addition to the E Group deviation, the presence of Early Classic carved monuments at Pacbitun, a rare commodity in the Belize Valley at this time, may be a vital source of information for understanding why this social divide existed. Therefore, it will be important, first, to detail Pacbitun's limited epigraphic record. This summary presentation of Stela 6 and Altar 3 will primarily highlight the evidence used to date each monument as well as information concerning Pacbitun's potential relationships and political status.

Epigraphic History of Pacbitun

One of the more peculiar features at the centre of Pacbitun is the large number of monuments present at the site, amounting to 13 stelae and 7 altars (see chapter two, this volume; Healy *et al*. 2004a:213). Most of these were erected in Plaza A sometime during the Late Classic Coc phase (AD 550-800) and Terminal Classic Tzib phase (AD 800-900) (see chapter two, this volume; Healy *et al*. 2004a:213-214). Of these 20 monuments, only a single stela (Stela 6) and altar (Altar 3) have evidence of carving. Yet, these two monuments were found broken and incomplete, intentionally fragmented in antiquity. Fortunately, the extent of this damage was not too significant, allowing researchers to piece enough together to analyse and interpret the carving of Stela 6 (Figure 9.2) and Altar 3 (Figure 9.3).

Analysis has confirmed that both monuments date to the Early Classic period (Helmke and Awe 2012:68-69; Helmke *et al*. 2006; Skaggs *et al*. 2017b). Stela 6 includes a Long Count date recorded in the primary text carved onto the right side of the stela. Owing to the fragmented and weathered state of this monument, the original reading had only included the baktun, katun, and tun positions of the Long Count date thought to read 9.2.5.?.?., indicating the date likely correlated to AD 475 (Healy 1990b). However,

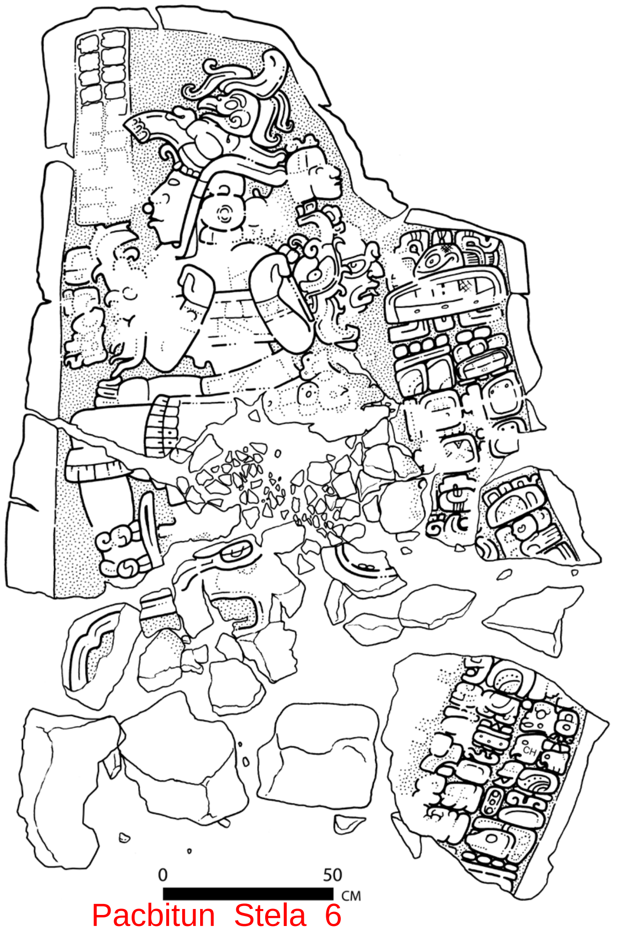

Figure 9.2. Stela 6 of Pacbitun (drawing by Christophe Helmke, after Helmke *et al.* 2006:71, Figure 1).

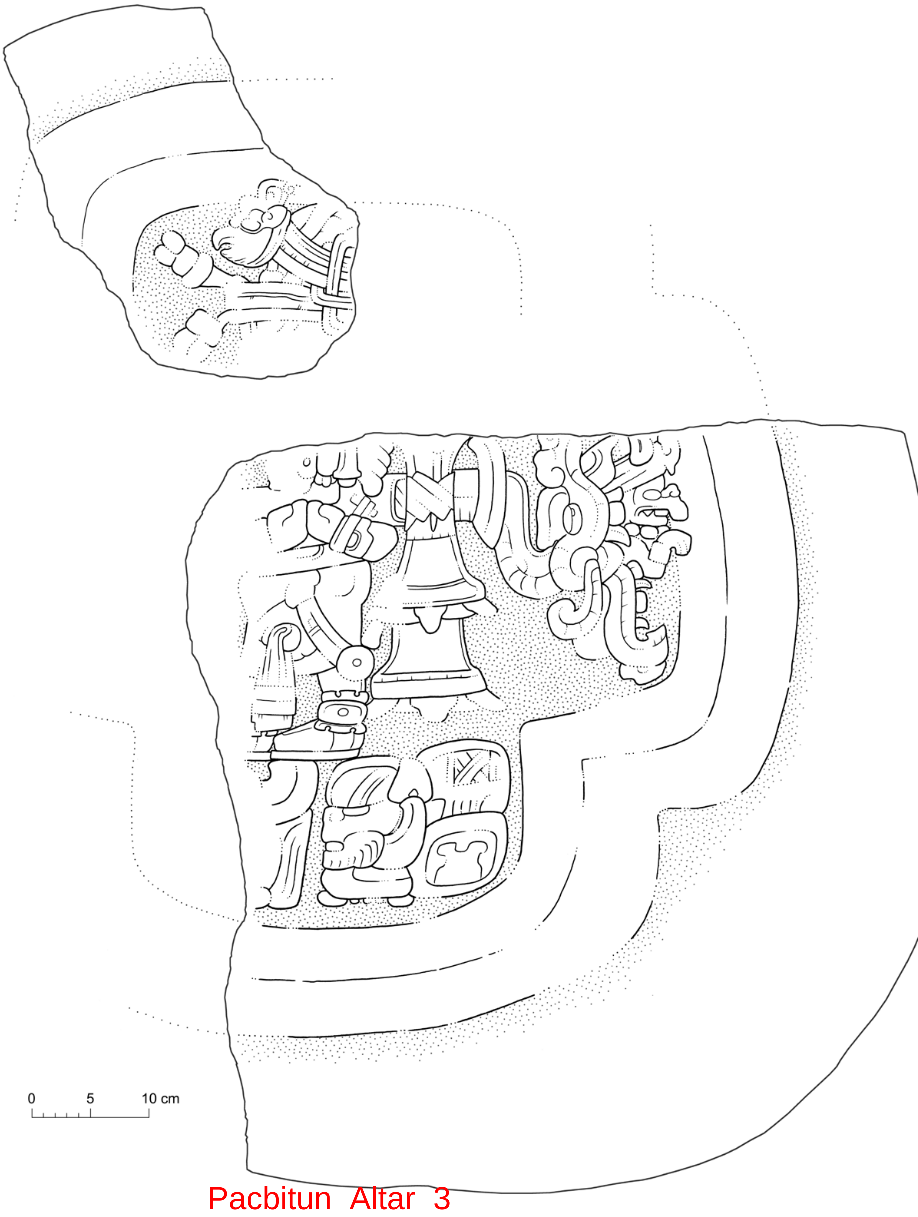

Figure 9.3. Altar 3 of Pacbitun, Belize (drawing by Christophe Helmke, after Skaggs *et al.* 2017a:119, Figure 4).

further analysis of Stela 6, several years later, found that the inscribed date actually recorded the *lahuntun* period ending date 9.2.10.0.0, correlating to AD 485 (Helmke *et al*. 2006). Iconographically, elements of regalia such as the nose bead and 'bib' confirm the Early Classic date (Helmke *et al*. 2006:72).

Although the inscription on Altar 3 does not provide a specific date, stylistic elements of the figure's posture as well as items of regalia, such as the belt chain and anklets (Jones and Satterthwaite 1982:106; Leventhal 1992:148-150; Proskouriakoff 1950:19-21), are closely in keeping with those depicted on other monuments dating to the Early Classic period (Skaggs *et al*. 2017b:116-118). Furthermore, the sinuous and animate characteristics of the serpent ceremonial bar also supports the Early Classic attribution (Clancy 1994:12-14). Another feature that helps to date Altar 3 are the paleographic features of the two remaining glyphs found in the bottom lobe of the quatrefoil that frames the scene. Only part of the first glyph block remains, which may have named the individual depicted, partially rendering a **yu** syllabogram in a style that has not been identified prior to AD 445 (Helmke and Nielsen 2013:153, 160; Skaggs *et al*. 2017b:118). Helping to cap the back half of a paleographic range for Altar 3 is a particular glyphic rendition of the 'cave' logogram appearing in the second glyph block—as this stylistic variant is not found after AD 534 (Helmke 2009:560-562; Skaggs *et al*. 2017b:119). Thus, a date range of AD 445-534 can be provided for this monument on the basis of paleographic features. In addition to dating, the usage of the glyph for 'cave' in conjunction with the preceding one for 'sky,' is a common 'locative expression' that identifies this glyph block as recording a toponym, or place name (Figure 9.4; Helmke *et al*. 2004; Helmke and Awe 2012:68-69; Skaggs *et al*. 2017b:118-120). Therefore, the second glyph block on Altar 3 is thought to refer to the ancient name of the Pacbitun realm (see Figure 9.3).

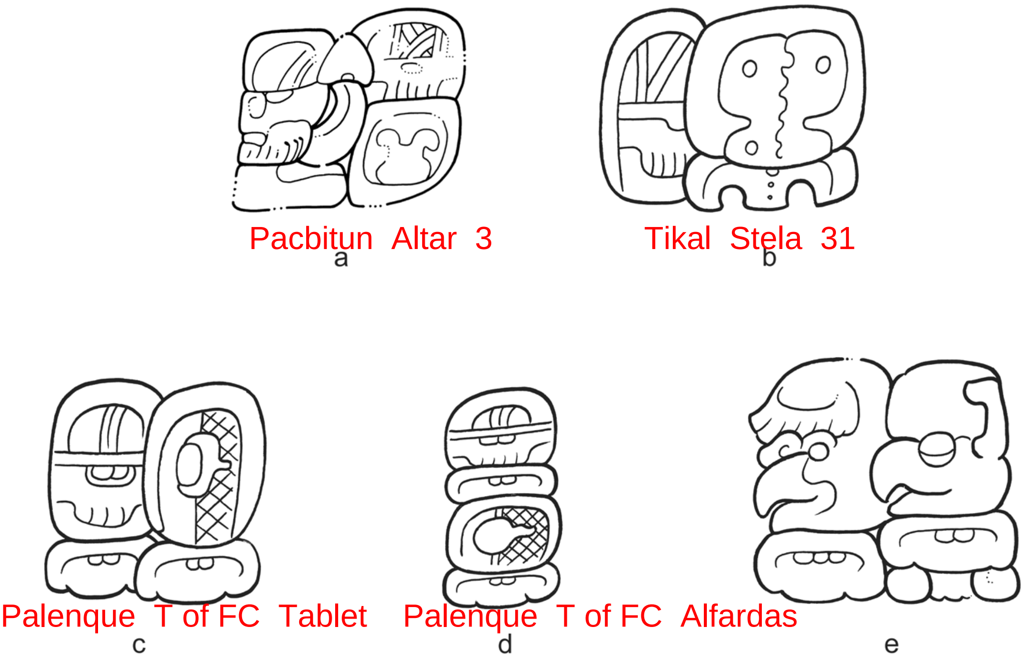

Figure 9.4. Glyphic examples of the 'sky-cave' expression involved in place names found on: a) Pacbitun, Altar 3, b) Tikal, Stela 31, c) Palenque, Tablet of the Foliated Cross, d) Palenque, Alfarda of Temple of the Foliated Cross, e) Copan, Temple 11 (drawings by Christophe Helmke after Stuart and Houston 1994: Figure 9).

Illustrating the site's Early Classic importance, the scenes carved onto both monuments depict the rulers of Pacbitun attired in elaborate regalia, with Stela 6 possibly depicting the accession of the king (Helmke and Awe 2012; Helmke *et al*. 2006). These scenes thereby confirm that Pacbitun was the seat of a royal dynasty by at least the Early Classic period and probably before. Moreover, potential references to the founding on this dynastic line may be presented iconographically on Stela 6. There, at the back of the belt of the seated ruler, we see a little maskette, showing a human profile. Details of such belt masks often refer to the venerated dead and through the inclusion of glyphic elements, the names of relatives and ancestors can be made out (Grube and Martin 2000; Schele and Miller 1986:71; Tuszyńska 2016). The two elements on the Stela 6 maskette are a scalloped headdress in the form of a **YAX** logogram and a large dot on the cheek of the human profile suggesting that this is the logogram **AJAW** (Helmke *et al*. 2006:72). Together, these elements would have read *yax ajaw*, or 'first king', which may well be a reference to the dynastic founder of Pacbitun (Helmke *et al*. 2006:72). Were this mask to represent the ruler's parent or grandparent, we might conjecture that Pacbitun's dynastic line began four or six decades earlier (given the average length of reign in the Maya area), yet the founding could conceivably be considerably earlier.

One of the first clues to Pacbitun's political situation at this time can be gleaned from the throne that the ruler is depicted to be seated upon on Stela 6. The iconography is distinctive for its depiction of a seated ruler and is thereby thought to show the accession of the local monarch. Now mostly destroyed, the throne is thought to be either supported by or fashioned into a large turtle identified by the entity's diagnostic eye, beak, and curved carapace (Helmke *et al.* 2006:72). What makes this image significant is its context with the throne, since emblematic glyphs found in basal registers typically provide toponymic references (Stuart and Houston 1994:57). As such, we can conjecture that this turtle in part serves to name the locality where this accession took place, either an actual historical location or an earthly emulation of a mythological place. The turtle's significance on Stela 6 is further supported by the primary text, where the nominal term *ahk'ul* 'turtle' occurs twice (Figure 9.5; Helmke *et al*. 2006:72). Comparable to the turtle on Stela 6 is the placement of Pacbitun's toponym beneath the feet of the ruler depicted on Altar 3, which provides the name of the ancient realm of Pacbitun. Given that the name of the realm does not include the segment *ahk'ul*, the accession depicted on Stela 6 may name a specific locality within Pacbitun, such as the name of a particular building.

Adding to the list of toponyms, another potential toponym glyph was identified within the primary text on Stela 6, which is described as the 'Bent Kawak' glyph (Figure 9.6). When involving the syllabogram **chi**, it is thought to reference a mythological place, or a locality of great antiquity (Grube 2004:36). When accompanied by the prefix **ko**, however, the toponym refers to a location in the eastern central lowlands between Naranjo and Caracol (Grube and Martin 2004; Helmke *et al*. 2006:74). The so-called 'Bent Kawak' logogram has recently been identified as a depiction of a metate that is propped up on a wedging stone, and as such the value **KA' ~ CHA'** has been offered by David Stuart (2014). Written together as **ko-KA'**, this would provide the toponym *Koka'* (possibly from *kok-ka'-a'* 'river turtle-metate-place') (Helmke and

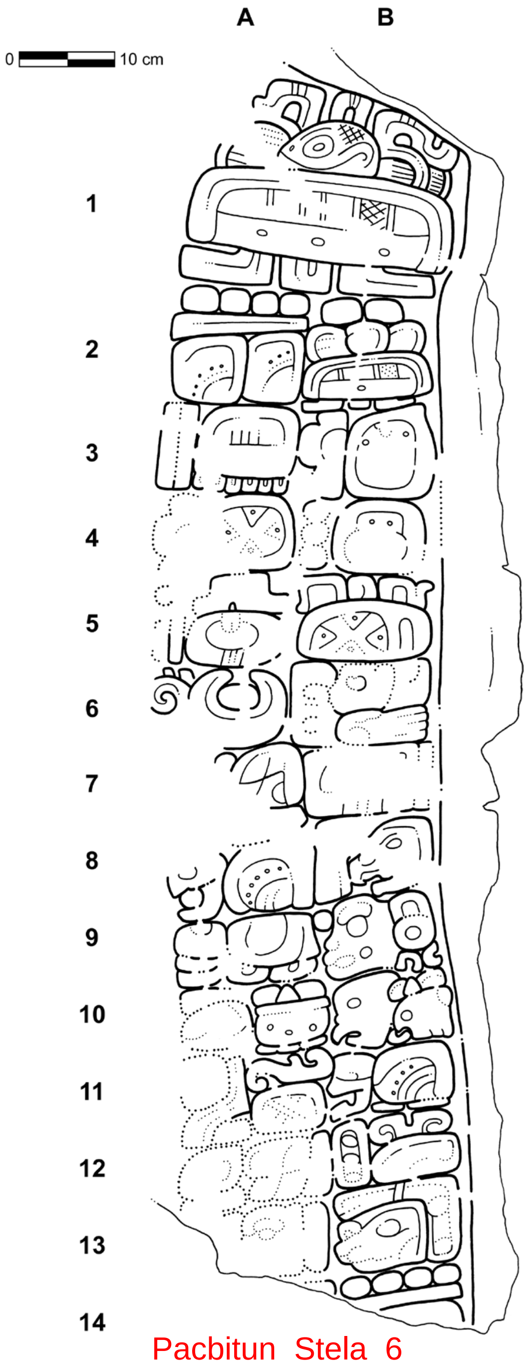

Figure 9.5. Primary text found on Stela 6 (drawings by Christophe Helmke, after Helmke *et al.* 2006:73, Figure 5).

Awe 2018). Discussed further below, mentions of this location in the epigraphic record could potentially attest to alterations at Pacbitun and interactions with this locality during the Late Classic.

Positioned in the upper left corner of Stela 6, is a secondary glyphic caption, which states that the protagonist was *johyaj* 'bound' or 'debuted' in a particular office or title (Figure 9.7; Helmke *et al.* 2006:74). This phrase is important as it confirms that the depiction was of the ruler's accession to a particular office. However, the most significant piece of information concerning Pacbitun's political status can be found in glyph block D2, identified as the 'agency expression,' read *uchabjiiy*, a metaphorical expression that is understood as 'he supervised it' (Figure 9.8; Helmke *et al*. 2006:74-75; Martin and Grube 1995:42-44; Martin and Grube 2000:20). In clauses involving these types of agency expressions the individual of lesser status is named first, with the superordinate agent, to whom credit is given for the action, named after the expression, in the subordinate clause. This is a meaningful statement, as it gives credit to a foreign overlord for the accession of the local king named and depicted on Stela 6 and, in turn, implies Pacbitun's status as a subordinate polity at this time. Regrettably, the subsequent glyphs bearing the name of the foreign overking are heavily eroded. Helmke and colleagues (2006:75), however, note that what remains of the outlines of these glyphs resembles the name of *K'an Chitam*, the contemporary king of Tikal, in the late 5th century (Martin and Grube 2000:37). This identification is consonant with the putative alliance between Tikal and Caracol, which may have been established as early as the reign of *Yajawte' K'inich* II (r. AD 553-593+), who in the early part of his reign maintained close ties to Tikal, until the fateful reversals of AD 556, which led to the reprisal and summary defeat of Tikal in AD 562 (Martin and Grube 2000:39).

Whereas these analyses are tentative, the text clearly implies Pacbitun's subordinate role in the Early Classic. Knowing Pacbitun's subservient status, the site's political ties may have made them a viable target, given what was, according to the epigraphic record, an extremely tumultuous time. The events of the southern Maya lowlands recorded during the Classic period detail an increasing amount of warfare

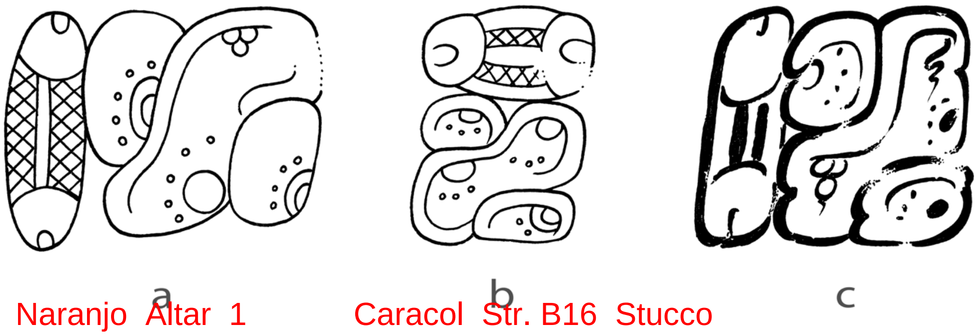

Figure 9:6. Examples of the 'Bent Kawak' or *Koka'* toponym in the eastern central lowlands. a) Naranjo, Altar 1. b) Caracol, Str. B16. c) K2573 (drawings by Christophe Helmke).

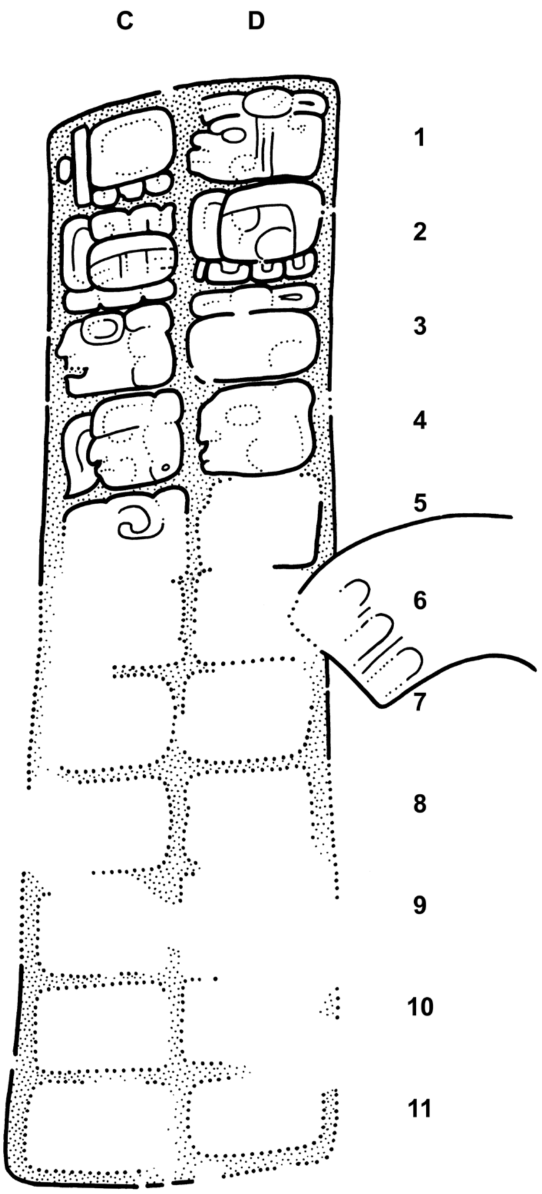

Figure 9.7. Secondary text found on Stela 6 (drawings by Christophe Helmke, after Helmke *et al.* 2006:73, Figure 6).

between the surrounding kingdoms during the second half of the Early Classic period that would continue to intensify in the Late Classic period.

Physical Examination of Pacbitun Monuments

The decipherment of the hieroglyphic writing system of the ancient Maya may well be the breakthrough that brought about the scholastic acceptance of Maya warfare (Webster 2000:68, 83). Thus, much of what is known about warfare comes to us from the written record (see Chase and Chase 1998:15, 17-18). Archaeologically, aside from the presence of defensive features or weapons (Demarest *et al.* 1997; Palka 2001), events of conflict and warfare can be identified through the desecration and destruction of architecture and material culture. While this type of destruction was, and still is, a common act of war, to the ancient Maya, the meaning behind this practice was deeper and its purpose more sinister than merely destroying the objects of their opposition. The Classic period Maya believed the body was composed of many souls or essences which could be moved into material objects (Houston *et al.* 2006:100-101). Deliberately destroying materials imbued with the essences of an individual was thought to despoil and ritually kill 'the animate supernatural power of an object, person, place, or portal to the other world' resulting in soul displacement (Pagliaro *et al.* 2003:77; see also Harrison-Buck 2016:64-65; Helmke and Brady 2014). The malevolent intention of this practice become more apparent when examining the specialised and procedural methods of desecration of portraiture, particularly when compared with the documented methods of and meaning behind the decapitation and mutilation of royal captives.

The Maya life-essence, referred to as *ch'ulel* in Tzotzil (Freidel *et al.* 1993:11), is thought to be most potent, powerful, and vulnerable in the head and face of an individual (Mock 1998:115-116; Freidel and Schele 1989). After discussing the reproductive, regenerative, ensouling, and individuating ideological properties of the Maya skull, Shirley Mock (1998) details the frequency of decapitation and flaying/mutilation of captives within the ethnographic and iconographic records to demonstrate its purpose as a method of displacing the vulnerable essence of the head and face to humiliate and debase social identity. Unfortunately for ancient Maya kings, the head and face of painted and carved portraits, considered by both elite and nonelite individuals to be an extension of the ruler (Harrison-Buck 2016:61; Stuart 1996:190), were also ascribed with a similar level of power and vitality. Knowing what these depictions personified, rivals could nullify a ruler's authority and identity and effectively harm or kill them by targeting the face or head of the portrait where the individual's essence is thought to reside (Houston *et al.* 2006:100-101).

O'Neil (2017:50) believes any physical alterations to monuments, minor or major, are 'marks of engagement […] designed to change the status of things, diminish or deactivate a monument's potency, maim or kill the monument, or hurt someone or something else by proxy.' However, O'Neil (2017) argues that not all defaced monuments are an act of desecration. She believes that portraits with pecked eyes, nose, and mouth with an otherwise unaltered integrity could actually signal a reverential act performed after a ruler's death, not to 'deactivate or neutralize' but to signal the ruler's transformation into an ancestor (O'Neil 2017:51). Left standing, these monuments become memorials and sources of past information (Just 2005). A similar argument was posed for many Olmec portrait monuments that were thought to have undergone a symbolic defacement to release the essence of the portrayed ruler shortly after death, signal a change in ruler or dynasty, and/or celebrate an important calendrical event (Grove 1980:63). Descecratory acts, on the other hand, were aimed to 'obliterate' the portrait's face and destroy the physical integrity of the monument ultimately causing it to collapse (O'Neil 2017:53). This

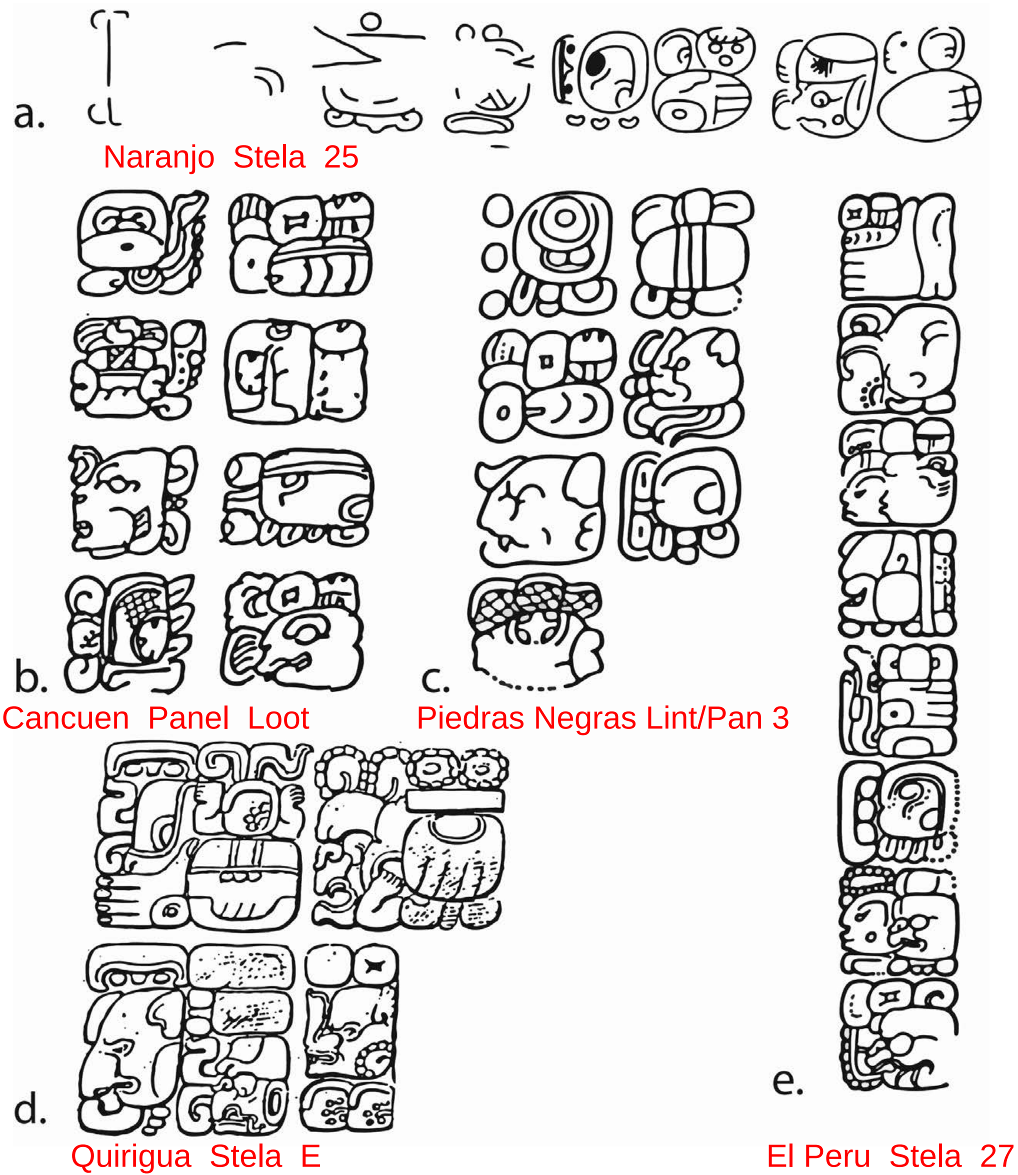

Figure 9.8. Examples of the 'agency expression' *uchabjiiy* in the glyphic corpus. a) Naranjo Stela 25 (Graham 1980:70); b) Panel from the Cancuen Region in a private collection, Guatemala (drawing by Linda Schele); d) Piedras Negras, Lintel 3 (drawing by Linda Schele); D) Quirigua Stela E (Maudslay 1889-1902, Vol. 2, Plate 31); e) El Peru Stela 27 (inked by Nikolai Grube after field drawing by Ian Graham); after Martin and Grube 1994, Figure 3.

type of destruction is thought to be evidence of warfare or regime change. Destroyed monuments at Caracol, Copan, Naranjo, Pomona, Tikal, and Uaxactun have been correlated to accounts of warfare documented in the epigraphic record of the victors (Chase and Chase 2003; Culbert 1991; Helmke and Awe 2018; Martin 2003; Martin and Grube 2000; Sharer 2004a). What is more, the impact that these warfare events had on the written record at many centres does not always end with the destruction of the losing side's existing monuments. Defeats have also been known to lead to decades of epigraphic silence, or hiatus, during which no monuments would be erected.

Although nothing more can be offered from the iconographic or epigraphic analysis of Pacbitun's monuments at this time, there is still much information that can be obtained by examining them from an archaeological standpoint. The destruction and displacement of Stela 6 and Altar 3 at Pacbitun is the most significant evidence that suggests the site's involvement in the Classic period conflicts previously discussed.

As discovered, Stela 6 measures less than 2 m tall, owing to its partiality as it was broken from its base in antiquity and displaced to its secondary context. Despite the fact that the ruler's face appears to be intact, the missing base clearly suggests that the integrity of the monument had been compromised indicating that this was an intentional act likely associated with warfare. While the entirety of the carved stone is fragmented, the most significant damage appears to be below the seat and feet of the ruler where the base had been broken away. It is interesting that the perpetrators chose, quite literally, to dethrone the ruler by obliterating his seat of authority where the location of this accession event may have been referenced as previously discussed. On the other hand, the destruction to Altar

3 is directed toward the monument's protagonist—the altar splintered across the face and over the glyph that may have once named this ruler. The fragmentation of Altar 3 thereby clearly served to destroy this monument's integrity.

Contextual Analysis of the Pacbitun Monuments

It is clear that monuments represented more than just images and texts carved onto stone to the ancient Maya. Imbued with the life-force of kings, stelae were representations of power, authority, and divinity in life and later served as memorials for veneration in death. Yet, these same attributes also made them targets during times of conflict and social upheaval. Once broken, any further engagement with what remained of these fragments depended on the state of those conquered. What happened to destroyed monuments after a warfare event can reveal much about the fate of a defeated centre. Some broken monuments, such as those associated with the abandonment at Piedras Negras and Yaxchilan at the end of the Late Classic period, were left where they fell (Houston 2014; Mathews 1988; O'Neil 2013). A different scenario befell Caracol and their hieroglyphic stairway, now scattered at a variety of sites in the eastern central lowlands, after their defeat in the late 7th century (Helmke and Awe 2018). In other cases, still, defeated centres collected and reused broken monuments which appear to have continued to carry special meaning. Stelae fragments at the centres of Cahal Pech, Calakmul, Copan, Lamanai, Tikal, and Uaxactun were buried reverentially within superstructures, shrines, and tombs—some with evidence of burning on surfaces above its burial indicating rituals of reverence and continued social memory (Awe *et al.* 2009; Ayala Falcon 1987; Coe 1990; Laporte and Fialko 1995; O'Neil 2009, 2017:58; Pendergast 1988; Pincemin *et al.* 1998; Schele and Freidel 1990; Smith 1950). Prior to interment, some monuments were initially put on display within these final resting places where they remained accessible for centuries after their dedication and destruction (O'Neil 2017:58). O'Neil (2017:57-58) proposes that caching or burying the monuments may have served to 'restore the dignity of the defiled ruler' and was 'akin to that of a human body.' Continuing with this line of thought, knowing that it was common practice to take rulers as captives during Maya warfare, burying a fragmented stela portrait, once considered to be an extension of the king, may be the only viable substitute in the absence of the ruler's body.

Acknowledging the importance of archaeological context, in addition to the physical condition of the Pacbitun monuments, more information can be gathered by examining the treatment of these fragments post-destruction. First, examining the two fragments that make-up Altar 3, these pieces were not actually found together but were discovered at two separate locations. And, in both cases, these fragments appear to have been treated reverentially. The larger fragment was discovered within Structure 1, the central building of the E Group's eastern triadic arrangement, during the investigations of the 1980s (Healy 1990a; Helmke and Awe 2012:68). There are two key details concerning the context of this monument that are important to note. First, the altar piece was not tossed haphazardly into construction fill but had been intentionally positioned along the primary axis of the building, carefully placed in a ritualised context as a cache (Healy 1989). Second, while this fragment was found within a phase of architecture dating to the latter half of the Early Classic period (AD 400-550) the architecture containing the fragment was intruded into meaning that the cache post-dates the second Early Classic construction episode (Healy 1989). Thus, it is possible that the placement of this cache may have been part of the Late Classic site-wide construction event that would uniquely modify Pacbitun's E Group variant, both physically and functionally, as discussed in the beginning of this chapter. It should also be mentioned that the Late Classic tomb constructed for Burial 1-9 had also intruded through previous phases of architecture and was covered over by the subsequent Late Classic constructions. Many other elite burials were also placed at this time signalling the assemblage's intensified shrine function.

The second, smaller fragment of Altar 3 was found nearly three decades later during the excavation of Structure 25, a residential structure bounding the eastern edge of Court 1, within the royal palatial compound. Although the edges of the two fragments do not directly conjoin, they both are composed of the same unique yellowish limestone and are outlined with the same distinctive quatrefoil band. Furthermore, the orientation of the quatrefoil band and remnants of a headdress fronted by an owl head illustrated on the newly discovered smaller fragment helped to identify this piece as the upper left corner of Altar 3 (Skaggs *et al.* 2017b:115). Upon discovery, the fragment appeared to act as part of the construction in a partition wall (oriented north-south) that served to divide the northernmost room of Structure 25 into east and west halves. Placed upright on a broken edge on the plaster surface of the room, the altar's rounded edge was fitted against the northern wall of this room with the carved side of the monument facing east and the smooth red-stained underside facing west (Figure 9.9; Skaggs *et al.* 2017b:115). Upon closer inspection, however, it appears that the altar was actually placed within a doorway that once allowed passage between the divided northern rooms (see Figure 9.9). This change in contextual detail is significant as its placement within this liminal threshold or passageway in one of the main elite residential compounds suggests it was part of a dedication or termination ritual (Harrison-Buck 2012:107; Mock 1998:6). In addition to its context, a dense ceramic scatter dating to the Late and Terminal Classic periods was found on the floor directly to the west of the altar fragment further suggesting that this was part of a ritual deposit. Interestingly, an earlier ceramic deposit dating solely to the Late Classic period was scattered on a floor belonging to a previous phase of architecture and associated with a bench-like feature which appears to suggest an on-going ritual function for this room. Although it is difficult to say

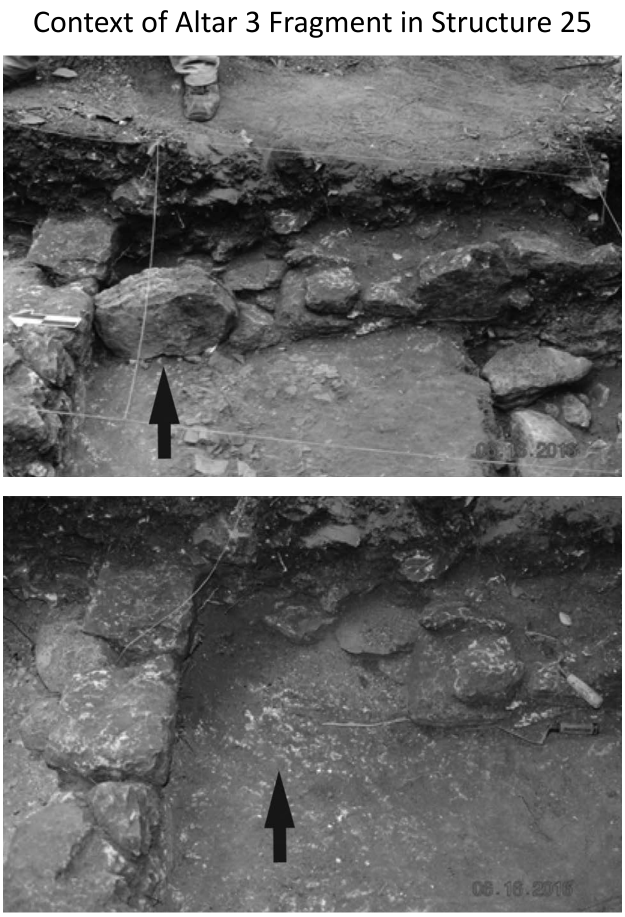
Context of Altar 3 Fragment in Structure 25

Figure 9.9. The context of the smaller Altar 3 fragment as discovered in Structure 25. The top image is of the monument, in situ, set against the east-west running wall and terminating on the northern end of the cut stone alignment. The bottom image shows the passage between an east and west room at the northern end of Structure 25 after the monument fragment was removed (photographs by Sheldon Skaggs).

with certainty, it is conceivable that the Altar 3 fragment was placed on display in this room for continued ritual reverence such as those discussed by O'Neil (2017).

In comparison with the treatment of the two carved altar fragments, the context of Stela 6 is remarkably different. The articulated fragments of Stela 6 were not discovered in a ritual context but were actually found lying face up on the terminal plaster floor in the southeastern corner of Plaza A, at the base of the E Group (Healy *et al.* 2004a:213). Excavations around the monument were unable to locate the base of the stela suggesting that its current location is a secondary context (Helmke *et al.* 2006:72). Although its original context has not yet been determined, stylistic continuities and the proximate dating of Stela 6 with Altar 3 may suggest that these two monuments were originally set as a pair, possibly in front of Structure 1 in the Early Classic. Furthermore, if these monuments were destroyed during a warfare event at the onset of the Late Classic period, it would seem unlikely that Stela 6 was left to lay in this location for the remainder of the site's occupation. It is more likely that the stela was placed on display for ritual purposes where it was left accessible for later displacement possibly during or after site abandonment.

Discussion

The architectural constructions and renovations coupled with signs of increasing material wealth at the onset of the Late Classic period (AD 550-800) mark a time of heightened prosperity at Pacbitun (Healy 1990a:257). However, the advent of this fluorescence appears to have been accompanied by a few significant alterations to social and political organisations primarily evident in the physical and functional modifications to the E Group complex. We strongly believe that these alterations likely resulted from the event or events that destroyed the carved monuments. As the evidence reported within this chapter suggests, the type of damage present on Pacbitun's carved monuments appears to denote desecration typically associated with martial actions. To better understand the Early to Late Classic affairs at Pacbitun, it is important to review the events recorded elsewhere in the southern Maya lowlands. Thus, using the dates and potential clues of affiliation offered by Pacbitun's Early Classic monuments, in conjunction with the site's archaeological evidence, it might be possible to determine if this event was associated with events recorded at other lowland sites.

Much of what is known about the Early Classic period comes from the monuments of Tikal with other contributions from central lowland sites (Mathews 1985; Schele and Miller 1986:27). The thorough record of Tikal's Early Classic phase is likely owed to their perseverance through the Preclassic collapse and their dominance throughout much of this time period (Martin and Grube 2000:25). Although the *entrada* event, associated with the 'arrival' of individuals from Teotihuacan around AD 378, appears to primarily impact Tikal, Mexican influence has been documented at other nearby sites such as El Peru, Holmul, La Sufricaya, and Uaxactun, and would have reached as far as south as Kaminaljuyu and Copan in the Maya highlands (Braswell 2004; Clayton 2005; Estrada-Belli *et al.* 2009; Martin and Grube 2000; Sharer 2004b). Interestingly, shortly after the *entrada*, we see the foundation of dynastic centres along the margins of the central lowlands (e.g., Palenque, Copan, and Quirigua) (Martin and Grube 2000:35; Schele 1992). The medium-sized centre of Pacbitun also appears to have been part of this Early Classic trend.

Archaeological evidence combined with a detailed hieroglyphic record indicates that Tikal was the most preeminent kingdom during the Early Classic period (Martin and Grube 2000). Even after the Teotihuacan *entrada*, Tikal's domain remained far-reaching, extending southward to Ucanal by the mid-5th century (Hellmuth 1988). Texts at Tikal also mention a dynastic link with Naranjo at this time, a centre known to have had heavily influenced the Belize Valley throughout the Classic period (Ball and Taschek 1991, 2004; Helmke and Awe 2012; LeCount and Yaeger 2010; Martin and Grube 2000).

However, by the mid-6th century, as carved monuments became more commonplace and the epigraphic record more detailed, the political atmosphere appears to intensify. It is at this time that Tikal's domination came to an end and the *Kanu'l* polity rose to power. Evidence of this power exchange begins with the supervision of Naranjo's 'Aj Wosal' in AD 546 by the then reigning *Kanu'l* king (Martin and Grube 2000). Just two years prior to this accession, Naranjo records a conflict with the nearby polity of *Koka'* (Grube and Schele 1993:3), the location that might also be named on Pacbitun's Stela 6. Also significant, Tikal's expanding reach would see increasing ties with Caracol accession by the mid-sixth century (Martin 2017:2-3). Despite what appears to be amicable relations at this early date, these are promptly followed by Tikal's axe event against Caracol in AD 556 (Houston 1991:40; Martin 2017:3). And finally, in AD 562, Caracol and their *Kanu'l* allies record the defeat of Tikal in a decisive 'star war' attack (Houston 1987:93, 1991:40; Martin 2017).

Fast-forwarding to AD 626, the Caracol and Naranjo wars begin with two separate battles between Caracol and *Koka'* the second reference to the toponym mentioned on Stela 6 at Pacbitun (Grube 2000:91-93). And in AD 631, the *Kanu'l* polity finally topples the Naranjo kingdom in allegiance with the forces of Calakmul. Interestingly, this is about the same time that the sites of the Belize River Valley begin to flourish—the defeat of Naranjo thought to give rise to autonomy in this region (Ashmore 1998, 2010; Ball and Taschek 1991; Healy 1990a; Helmke and Awe 2012:65; Helmke *et al*. 2010). Almost five decades later, in AD 680, Naranjo retaliates and defeats Caracol, this being the event most likely associated with the destruction and theft of Caracol's hieroglyphic stairway (Helmke and Awe 2016a:2, 2016b:2; Martin 2017). While Caracol's defeat leads to a 118-year hiatus, a single surviving text on Stela 21 may record the defeat of Pacbitun and the capture of its ruler in AD 702—the Emblem Glyph that closes the name phrase of the captive bearing a strong resemblance to the name of the Pacbitun toponym (Helmke and Awe 2012:68-69).

Knowing Tikal's domain and their link to Naranjo during the 5th century AD, Pacbitun could have easily been directly or indirectly incorporated into these hegemonic regimes. If this were the case, Pacbitun may have been a casualty during the conflicts leading up to the fall of Tikal in AD 562. The apparent reference to *Koka'* on Stela 6 suggests a relationship with this polity, and Naranjo's attack on the neighbouring polity in AD 544 and Caracol's double attack against the same site in AD 626 may have made Pacbitun a vulnerable target as well on the very same dates. The latter date is of interest as many agree that Caracol's attacks on neighbouring allies of Naranjo prompted the eventual defeat of Naranjo in AD 631, leading to a five decade-long reprieve for the sites of the Belize River Valley (Ashmore 1998, 2010; Ball and Taschek 1991; Healy 1990a; Helmke and Awe 2012:65; Helmke *et al*. 2010). This date may be further supported by the early Coc phase modifications to Pacbitun's ceremonial assemblage, now equipped with all the attributes of an Eastern Triadic Assemblage. Thus, the evidence would seem to suggest that Pacbitun's early Late Classic relations are with their northern neighbours of the Belize Valley.

Conclusion

As an incorporated provincial polity at the end of the Early Classic period, Pacbitun would have been caught in the middle of competing kingdoms. Although the Pacbitun monuments do not contain information regarding conflict, the examination of the physical condition of these monuments clearly demonstrates the desecratory nature of their fragmented state. Targeting the face of the Altar 3 individual and destroying the integrity of Stela 6, these perpetrators were aiming to harm or kill the embodied essence of both rulers depicted on each monument in an effort to extinguish Pacbitun's dynastic line. However, the context in which some of the monument fragments were discovered at Pacbitun does not suggest a hostile takeover since most had been interred with reverence or possibly even placed on display to be venerated for a period of time. This treatment would seem to indicate that Pacbitun retained a fair degree of autonomy after the conflict event. Furthermore, the Late Classic florescence at Pacbitun, like the sites of the Belize River Valley, appears to infer that the site may have actually benefitted from this conflict as a result of their new-found autonomy. With that said, the socio-political change evinced by the alterations to Pacbitun's civic-ceremonial architecture would most likely be the product of a closer relationship with the Belize Valley region.

Acknowledgements

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10

The Ceremonial Karstscape of Pacbitun

Jon Spenard, Michael J. Mirro, and C. L. Kieffer

This chapter presents an overview and analysis of the regional ceremonial karst landmark survey in the greater Pacbitun region. This component of the Pacbitun Regional Archaeological Project (PRAP) was conducted in two phases from 2010-2013 and 2016-2018, and focused on three regions to the southeast, south, and southwest of Pacbitun. Guiding our research was a desire to better understand the Maya term, *ch'een*, a word commonly glossed as 'cave', but that refers to a wide range of natural and constructed ritual places. We have documented approximately 70 ritually used sites including, caves, rockshelters, sinkholes, bedrock outcrops, boulders with slight overhangs, cliff faces, and a variety of cracks and crevasses (Spenard 2014). It is important to note that the project never 'discovered' any of these sites. They have long been known to the people of San Antonio, and they shared the locations of them with us. The interiors and exteriors of these features contain ample material evidence of ritual use—shattered and cached ceramic vessels, chert flakes, obsidian blades, caches, and human remains in some—and in nearly all instances they were modified with a variety of crude architectural constructions using uncut and dry-laid stones. Among the most common constructions encountered were artificial floors, terraces, and rock alignments acting as framing devices, pot stands, and for other unknown functions. While elite use for public-scale water-related rituals is indicated in several of the caves, the sheer volume of modifications we recorded and the small-scale size of most in nearly all of the known features indicates ceremonies in *ch'een* were being performed by all members of the broader Pacbitun community.

History of Research

Archaeological caves had been documented in the Pacbitun region decades before that site was known to archaeology. The earliest mention of caverns in scientific literature was made by J. Eric S. Thompson (1939:282) who reported on multiple private pottery collections obtained from caves around San Antonio Village, Cayo, grouping them with the Rio Frio Caves to the south (Spenard 2018). Unfortunately, he never names nor provides a map of their locations, nor does he offer descriptions of them. A second report of caves in the Pacbitun region appears on a map of known archaeological sites in Belize, produced for a British land use survey (Wright *et al*. 1959: Figure X). The authors indicate two 'caves with archaeological remains' as the only pre-Hispanic sites in the region. At that time, Pacbitun was not yet known to science (see chapter two, this volume). Based on their plotted locations on the map, one is likely Offering Cave, a massive subterranean cavern outside of the Pacbitun study region, and the other is likely Actun Lak, discussed below.

Many of the karst features of the current study were first recorded by the Mendip Group, a club for cavers based in England. The goal of their Belize expedition was locating, exploring, and surveying caves west of the Mountain Pine Ridge (Hollings 1996). Their descriptions of the caverns are short, and the presence of archaeological material was noted irregularly in their reports (Flavell *et al*. 1994).

The first archaeological cave investigations in the Pacbitun region were conducted by Paul Healy and Jaime Awe's Belize Valley Preclassic Maya Project in Actun Petz (now Pech; see chapter two, this volume). That project's research goals were determining when the cave was used, why it was, and what was its relationship to Pacbitun (Healy *et al*. 1996:139). Their investigations involved only mapping the site and performing field analyses of archaeological materials encountered. They reported the Maya made extensive modifications to it, particularly in the entrance area, which contained four stepped terraces. Healy's team also recorded six sets of articulated human remains, one of only four karst features still known in the Pacbitun region to contain human osteological material (Healy *et al*. 1996). Twenty-three whole or partial vessels, and ceramic sherds were also present, but lithics, faunal bone, and shell artefacts were absent (Healy *et al*. 1996:144). Sixteen of the vessels are undecorated jars placed in clusters in hidden alcoves and wall niches, but the overall assemblage includes materials from the Ku phase (ca. 100 B.C.) through the end of the Tzib phase (ca. A.D. 900; see Table 1.1 this volume; Healy *et al*. 1996). Healy's team concluded the chronology of cave use sufficiently overlapped with that of Pacbitun, and it was geographically close enough that people affiliated with that settlement were the ones most likely using it.

Prior to the authors joining the PRAP, members Powis and Weber documented three cave sites new to archaeology and revisited Actun Pech to determine if the cave had been looted, and to what degree since being described by Healy's team (Powis 2010; Weber and Powis 2011). The new cave sites are Tzul's Cave, Crystal Palace, and Actun Merech, of which the former two were the primary subjects of our Phase II investigations discussed below. Unfortunately, evidence of extensive looting was recorded (Powis 2010:156). The skeletons had been scattered and several pots had been removed. Actun Merech has yet to be thoroughly investigated, and thus we do not discuss it further in this chapter. A diminutive rockshelter, Chaan Hol, located near Crystal Palace cave was investigated by other members of the PRAP in 2011 (Lee and Valdez 2012). Their work revealed evidence of extensive floor levelling over the course of the 3 m wide by 12 m long feature, constructed sometime between the Late Coc through Tzib phases. As discussed below, such major yet subtle modifications were a common practice of the Pacbitun Maya in the karstscape.

Theoretical Overview

What is a cave? This seemingly simple question guided the 'cave' research at Pacbitun. From a Western perspective, a cave is a natural hole in the ground large enough for a human to enter and that has a similarly large area where sunlight never reaches. Yet, a good portion of the world's caves, including those discussed in this chapter, are found in karstified limestone, that is limestone bedrock that has unevenly dissolved over the course of geologic time (Palmer 2007). As the dissolution is an unpredictable process due to the highly variable nature of the parent rock, crags and crevasses of all shapes and sizes are created, from microscopic joints to miles wide cracks above and below ground. Some terminology exists in English to classify different types of karst features, such as: rockshelter', an overhang in bedrock or a boulder large enough for a person to enter, but that does not have a dark zone; 'sinkhole', or 'doline', a subterranean chamber whose ceiling has, or is in the process of, collapsing, and which may or may not have a dark zone; and '*cenote*', originally a Mayan term, *dzonot*, that was adopted into Spanish, and refers to a particular type of sinkhole that has steep walls and whose floor reaches the underground water table. These terms are not mutually exclusive as they can be used to describe different parts of a karst system. For example, a cave may have a rockshelter entrance, a rockshelter may have a cave component, and a cenote may connect to a larger cave system or can be inside a cave.

'Caves' were of the utmost importance for pre-Hispanic period Maya people as the term for them, *ch'een* (pl- ob), is one of the most frequent glyphs in Maya inscriptions (Vogt and Stewart 2005:157). Although commonly glossed as 'cave', the term encompasses a much broader array of places on the landscape including natural and human-made features (Laughlin 1975:132; Vogt and Stuart 2005). In fact, a more recent reading of the term and the literary contexts in which it is found suggests it might actually be a general metaphor for sacred locations where Earth forces can be communicated with (Astor-Aguilera 2010; Brady and Prufer 2005; Tokovinine 2013:36). Pre-Hispanic Maya people performed rituals in artificial and architectural *ch'eenob*, mines were depicted as the abodes of Earth forces, and the temples on top of pyramids and the tombs inside them were also considered *ch'eenob* (Brady 1991, 2004, 2012; Brady and Ashmore 1999:134; Brady and Veni 1992; Fash 2001:123; Stone and Zender 2011:136-137; Stuart 1987:18). Archaeological research conducted over the past two decades confirms this broader understanding of the term. In addition to excavated and architecturally constructed caves, archaeologists have demonstrated pre-Hispanic Maya people performed rituals analogous to those conducted in caverns in a wide variety of karst features, including rockshelters, sinkholes, cenotes, and around bodies of water (de Anda *et al*. 2019; Awe et. al. 1998; Bonor 1989; Brady 1997; Griffith 1998, 1999; Ishihara-Brito 2008; Kinkella 2004, 2009; Mirro *et al*. 1999; Morton 2015; Moyes *et al*. 2012; Palka 2014; Peterson 2006; Prufer 2002; Rissolo 2003; Slater 2014; Spenard 2006, 2014, 2017). Nevertheless, the collective focus of cave archaeologists has often been on those caverns and rockshelters that are relatively large, even though evidence of ritual use of more diminutive features is regularly attested to by the presence of ceramic sherds and modifications in a variety of small features such as large boulders with overhangs, or irregularities in otherwise straight walls of bedrock outcrops, such as alcoves and cracks (Spenard 2006, 2014). As such, one of the primary goals of the ceremonial karst research at Pacbitun was including such small karst features in our survey and determining if they too were considered *ch'een*.

Undoubtedly, the Maya shared with other Mesoamerican peoples a core cosmology centred on caves, mountains, and water, and the ritual practices associated with them (Lopez Austin 2001). Rituals to the Earth forces and ancestors inhabiting the landscape were vital for the world and human life to continue (Brady and Prufer 2005). We acknowledge here the foundational theoretical landscape work of scholars such as Broda (1982, 1996), Garcia-Zambrano (1994), Heyden (1973, 1975), and Lopez Austin (2001). We also recognise that important anthropological and archaeological research related to this shared cosmology has been conducted outside of the Maya area by researchers such as Acosta (2011) in Chiapas, Manzanilla (2000; Manzanilla *et al*. 1994) at Teotihuacan, Monaghan (1995) in Oaxaca, and Townsend (1979, 1982, 1992) in the Valley of Mexico, but in both instances we have focused our discussion only on Maya examples in this chapter for sake of space. For a more comprehensive discussion of this core cosmology related to Mesoamerican landscapes, see chapter thirteen, this volume.

In general, we avoid using the term 'cave' as a general descriptor for the karstic landmarks discussed in this chapter because that word suggests a particular grandeur and structural complexity that is lacking in many of the sites we investigated. Instead, we frequently use the more neutral term, 'karst feature' as a general referent for all of them, including proper caves. Further, we employ the term, 'karstscape' to collectively refer to and acknowledge the variability of karst features, including large caves and rockshelters, that the pre-Hispanic Maya ritually interacted with, and thus doing so necessitates understanding them in relation to one another, and to the overall natural and cultural geography of which they are a part.

Surveying the Karstscape

The karstscape research discussed in this chapter was conducted in two phases, during which we focused on three clusters of caves to the southeast, south, and southwest of Pacbitun. None of them are more than 3 km from that site; most are much closer. Additionally, they are also close to, and known by, people in the nearby San Antonio Village. Unfortunately, all but a few of the features have been heavily looted; therefore, to protect them from future damage, and to conform to international caving ethics, overview maps of locations are not provided in this volume. Phase I of the research ran from 2010-2013 and incorporated regional reconnaissance but was largely focused on Actun Lak and Rocky Crab caves, Actun Naj Che rockshelter, and the Nohoch Tunich Bedrock Outcrop complex that capped the hill above them, all to the southeast of Pacbitun (Spenard 2014). Phase II investigations were conducted from 2016-2018 and were focused on Crystal Palace to the south of Pacbitun, and Tzul's and Slate caves to the southwest of it.

Because our research focuses on both traditional caves and large, irregularly exposed regions of bedrock outcropping where other types of karst features are found, we had to develop novel survey techniques that would allow us to accurately and quickly survey the sites and the land surrounding them. During Phase I, we developed a hybrid technique combining baselines with tape, laser rangefinder, and compass surveys. The first technique involves establishing a series of interconnected, string baselines in an area to be mapped, and starting and ending points of each used as datums incorporated into the overall map. Distances to pertinent features and cave walls were collected using a tape measure extended perpendicularly from the baseline. Such data points were collected at regular intervals determined by the scale of the map being produced, although most are set at either 25 or 50 cm increments. The benefit of this technique is its ability to capture fine-grained detail about archaeological remains and their overall contexts, but it is hindered by the large amount of time necessary to collect all the data points. This issue becomes particularly problematic in areas where few or no archaeological remains are found because the tradeoff between effort expended and potential knowledge to be gained is minimal.

The latter part of the hybrid technique is the traditional method of cave mapping that typically involves a team of three surveyors, one to draw the map, another to read the instruments, and a third to run a tape measure from pre-established datums to the point recorded (Dasher 2011). The initial component of the survey establishes a series of datums throughout the areas to be mapped. The person drawing the map sketches in the details between each of the datums, while the other two provide measurement data. The benefit of this technique is that it allows mapping to proceed quickly and relatively accurately on a large scale, although its ability to capture detail sufficient for archaeological purposes is lacking because the locations of objects and features are estimated, and the scale is typically too small for understanding context. This technique was used primarily when mapping bedrock outcrops with substantial spatial gaps between cultural contexts, and the baseline mapping technique was retained for the cultural features. Combining these techniques allowed for creating selectively detailed maps uniting all the cultural features on one general drawing (Figure 10.1). Overall, the utility

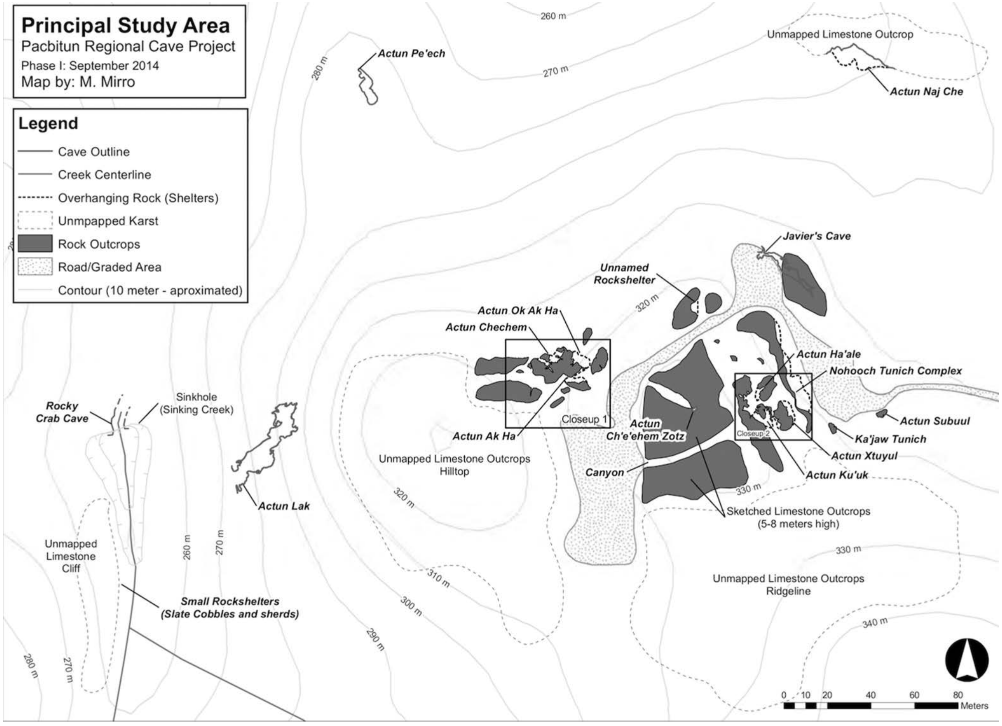

Figure 10.1. Overview map of Phase I survey area (Spenard 2017).

of the hybrid mapping technique used on this project is that it allows a feature to be mapped relatively quickly while retaining useful level of archaeological detail.

During Phase II of our research, a major focus of the survey was the advancement of cave mapping techniques using Structure-from-Motion (SfM), a form of photogrammetry made available to researchers with the advent of digital photography. This survey was complementary to the other digital surveying activities conducted on the PRAP (see chapter seven, this volume). SfM is a recent advance in photogrammetry where no reference information is required, resulting in a relative unscaled and unoriented model. Using SfM methods and software, a subject or scene is photographed as an overlapping series of digital images and software solves the geometry of 3D positions and camera location (Westoby *et al*. 2012). The resulting model has an accuracy and detail that far exceeds hand drawn maps, while field time to produce the model is minimal.

In Phase II, SfM became the primary method used to document features and excavation units and to a lesser extent, chambers, large areas of cave floor, activity areas, and passages. Areas of interest, or scenes, were illuminated with video lights strategically placed to create even lighting and photographed using tripod mounted digital single-lens reflex (dSLR) cameras. Camera locations were selected to ensure 50 percent overlap between shots, and that any given point within a scene is contained within at least three pictures. Scale bars, north arrows, and mapping grid points were included in all scenes so that the resulting model could be scaled, oriented to north, levelled, and properly aligned with other mapping data. Photographs from each scene were processed using Agisoft Photoscan software, generating 3D models. In Photoscan, the model would be referenced to the cave grid and exported as an orthophotograph and digital elevation model (DEM), which would then be imported to ArcMap and incorporated into the overall cave map and cave GIS. Using the DEM, orthophoto, and other data collected during mapping, the SfM data would be used to improve the quality of overall cave map and to produce highly detailed cave feature drawings. Many of our models can be accessed at the websites: https://sketchfab.com/jonspenard and https://sketchfab.com/cavearch.

The primary benefit of this technology has been an increase in the number of features and excavations mapped each field season, saving valuable field time as well as an increase in detail and accuracy of each map. Additionally, while traditional documentation may only result in a single plan view and sometimes a profile (depending on the feature or excavation), a 3D model can be oriented, sliced in any direction as a profile, and re-measured in any way. Since the model generated from photographs, there is little room for mapping error. These virtual recreations of features and excavations are an important development in digital archaeology because they provide more immersive experiences allowing other researches to more thoroughly explore the environment. They provide researchers a tool to write more detailed and accurate descriptions of the cave environment when they have left the field and attempt to translate their notes taken earlier. They assist other researchers who have not visited the environment a more concise experience allowing them to better compare their own research with what is being presented in the virtual environment.

Phase I Investigations in the Pacbitun Karstscape: Actun Lak, Rocky Crab Cave, and the Nohoch Tunich Bedrock Outcrop Complex

In this section, we discuss the four landmarks that were the primary foci of investigations during our Phase I research, Rocky Crab Cave, Actun Lak, the Nohoch Tunich Bedrock Outcrop Complex (NTC), and Actun Naj Che. They are all located on the same hill 1.5 kms from Pacbitun. With an entrance half-way down the hillside, Actun Lak is a 40 m long cave with three chambers, created by the collapse of a large block from the ceiling in antiquity (Figure 10.2). Rocky Crab cave is at the foot of the hill, with an entrance at the end of a seasonally active creek. This cavern acts as a drain for the surrounding landscape, and the water from the creek cascades over a 10 m drop choked with massive boulders, to the floor of the cave. Inside, the main passage continues for 325 m with ceilings reaching 30 m in height. The NTC is an exposed limestone bedrock outcropping of approximately six acres protruding from the top of the hill the other two caverns penetrate. It is composed of numerous small rockshelters, cliff-like exposures, boulders, and small caves, several of which are described below. Actun Naj Che is a shallow rockshelter within another massive bedrock exposure lower on the same hill as the NTC. It is 30 m long and of comparable size to the namesake rockshelter in the NTC, making it ideal for a comparative study.

Rocky Crab Cave and Actun Lak

We begin our discussion with Rocky Crab Cave, the landscape drain, due to the archaeological evidence found outside of it, rather than what little was found within it. More specifically, the characteristics of this cave are vital for understanding how Pacbitun Maya peoples, especially the elite, were interacting with Actun Lak during the Tzib Phase. Rocky Crab Cave intakes massive quantities of water during the rainy season, causing the interior to regularly and violently flood. As a result, any evidence of ritual use by Pacbitun Maya peoples is long gone if it were ever present. Moreover, there are only two known ledges or elevated side passages in the cave, one of which contained a smattering of evidence of ritual use—a few non-diagnostic ceramic sherds and clusters of imported stone. The other passage was unreachable without climbing gear and remains uninvestigated by us, although mapped by the Mendip Group (Flavell *et al*. 1994). Nevertheless, outside the cave, the Maya constructed a long series of crude cobble stairs leading 50 m up the steeply sloping (~30°) hillside to the entrance of Actun Lak, physically

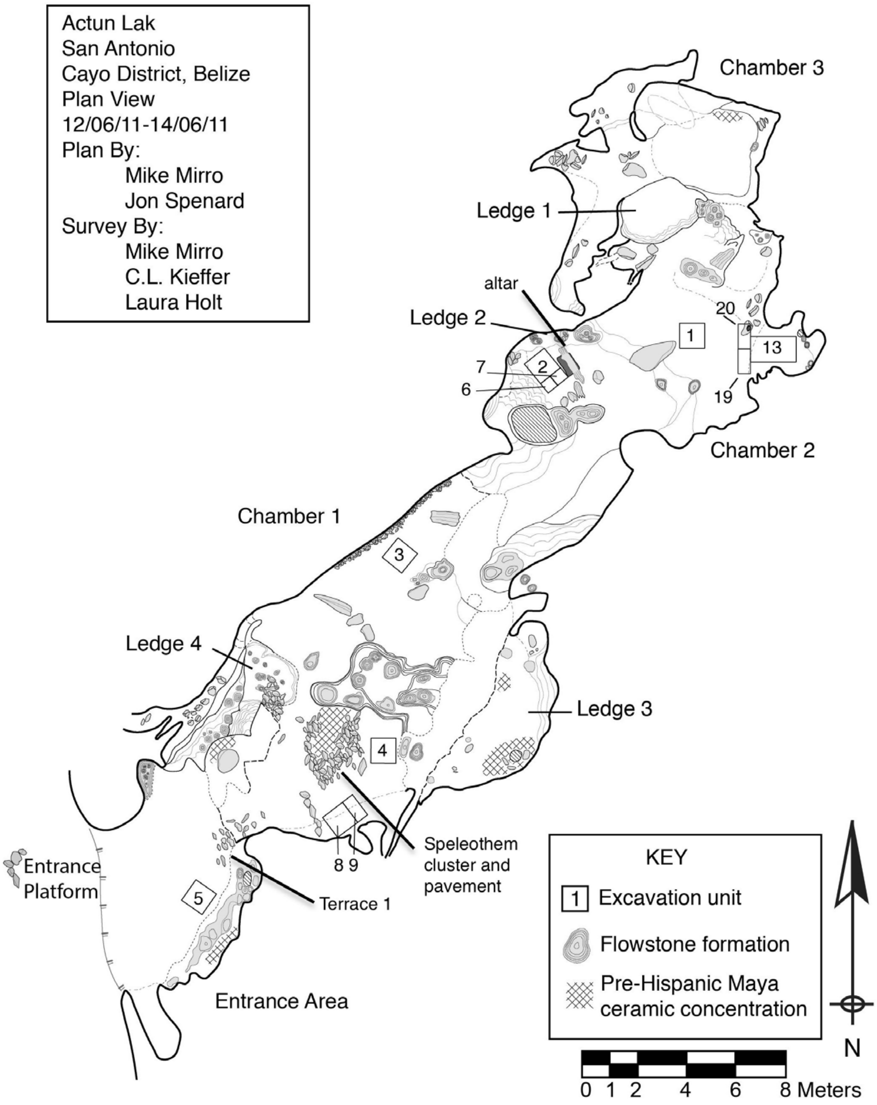

Figure 10.2. Map of Actun Lak showing locations of excavation units and architecture (Spenard *et al.* 2013).

connecting the two caves and making them part of the same ritual circuit. Ceramic sherds litter the entire hillside between Rocky Crab Cave and Actun Lak, but neither modifications nor artefacts were encountered above the latter cave until cresting the hill to the NTC.

The stairs were created from uncut cobbles placed on top of a thin limestone pebble and ceramic sherd fill placed on the hillside and areas of exposed bedrock. Many of the sherds collected in our excavations were large and angular, suggesting they had moved very little from their initial deposition. If the sherds had tumbled down the hill from above, they would have rubbed against one another and the many rocks they were intermixed with resulting in more rounded and smaller sherds than we recovered. All the identifiable sherds date to Late Coc through Tzib phases.

The cobble staircase terminates in front of Actun Lak's west-facing entrance at the foot of a 5 m by 5 m earthen-rubble platform dubbed the 'Entrance Platform.' The platform's north and south edges are bounded by short retaining walls keeping at bay the steeply sloping ground on either side of the cave entrance. The retaining walls incorporate small, natural outcrops, particularly to the south where another platform higher up on the hill may be present, although time did not allow for testing for it. The eastern or rear edge is defined by a steep slope beginning just outside the cavern's dripline, but a slate 'step' located halfway down it reveals the construction extended into the cave.

The platform was created during a single construction phase whereby the Maya excavated a 5 m by 5 m pit up to 2 m deep in front of the cave, which they proceeded to fill with large limestone boulders, cobbles, and a clay and ceramic matrix all imported from elsewhere to create the platform. In the centre of the platform, on the current ground surface, were two large polychrome sherds, one identified as a Benque Viejo Polychrome type (Smith and Gifford 1966:155) bowl, and the other a heavily burned Palmar Orange type dish (Smith and Gifford 1966:160), both dating to the Late Coc through Tzib phases. In fact, all the identifiable ceramics recovered from excavations within the platform date to those same phases.

The immediate area behind the Entrance Platform is the start of a steeply downward sloping passage dubbed the 'Entrance Passage.' That passage is approximately 8 m long and terminates at a sheer, 3 m drop into the first of three chambers in the cave. The only flat spot in the entire Entrance Passage is a 1.5 m by 1.5 m area against the southern cave wall, made by a small terrace of dry laid, uncut stone. The terrace, 'Terrace 1', is between four to six courses of limestone rocks high and stands approximately 70 cm above the current cave surface. It was placed so that anything or anyone on it would only be visible from the Entrance Platform, and hidden to anyone in the cave, suggesting any activities associated with it were to be witnessed outside.

A single excavation unit in the centre of the terrace revealed it was built during one construction phase, sometime after AD 820. As with the cobble staircase and Entrance Platform, most ceramics from the excavations of Terrace 1 were stylistically dated to the Late Coc through Tzib phases, although some were from earlier time periods, and we recovered a few Canto phase sherds near the bottom of the unit. Two metres below the terrace's surface, and nearly 1.5 m beneath the contemporary ground surface, the Maya had laid down an artificial slate floor extending out in all directions beyond the walls of the unit. Beneath the slate floor was a complete prismatic obsidian blade, and below that, a shattered but complete Altar Orange bowl (Adams 1971:27). Altar Orange is a type of Fine Orange pottery that first appears in the greater eastern Peten area after AD 820, providing a *terminus post quem* date for the terrace (Foias and Bishop 1997). We ceased our excavations at 180 cm below the current surface due to the instability of the walls; culturally sterile matrix was never reached. Overall, our excavations revealed the terrace to be part of a much larger construction project encompassing the entire Entrance Passage, a construction effort that resulted in raising the floor at least 3 m and abutting the Entrance Platform.

Terrace 1 is located on a 3 m high precipice dropping into Chamber 1. The primary cultural feature there is a cluster of intentionally broken stalagmitic formations. At the foot of the cluster is an artificial pavement of limestone rocks, cave formations, and imported river cobbles that have been partially cemented in place from the water that actively drips from the ceiling during periods of rain (Figure 10.3). A thick carpet of ceramic sherds covers the pavement and make up the matrix of the floor surrounding it. Stylistically, the ceramics date from the very end of the Puc phase through the Canto Phase, with the most intense use occurring during the former through Tzul phases. The remains of thousands of Hewlett Bank Unslipped type bowls (Gifford 1976:190), a plain ware type, often poorly and crudely executed, used for making individual offerings, dominate the assemblage there. Surprisingly, only one piece of the type has been found anywhere else in the Pacbitun karstscape yet investigated. The sheer quantity of these vessels found in Actun Lak strongly point to broad community use of the cave at the end of the Preclassic and first centuries of the Early Classic period.

In Chamber 2, the Maya constructed an altar from three speleothems (columnar cave formations) as its base, and a cut piece of cave curtain for its top (Figure 10.4). Everything in the room is charred black and covered in soot from burning events performed at the altar. As discussed by Parker (2014; see also chapter eleven, this volume),

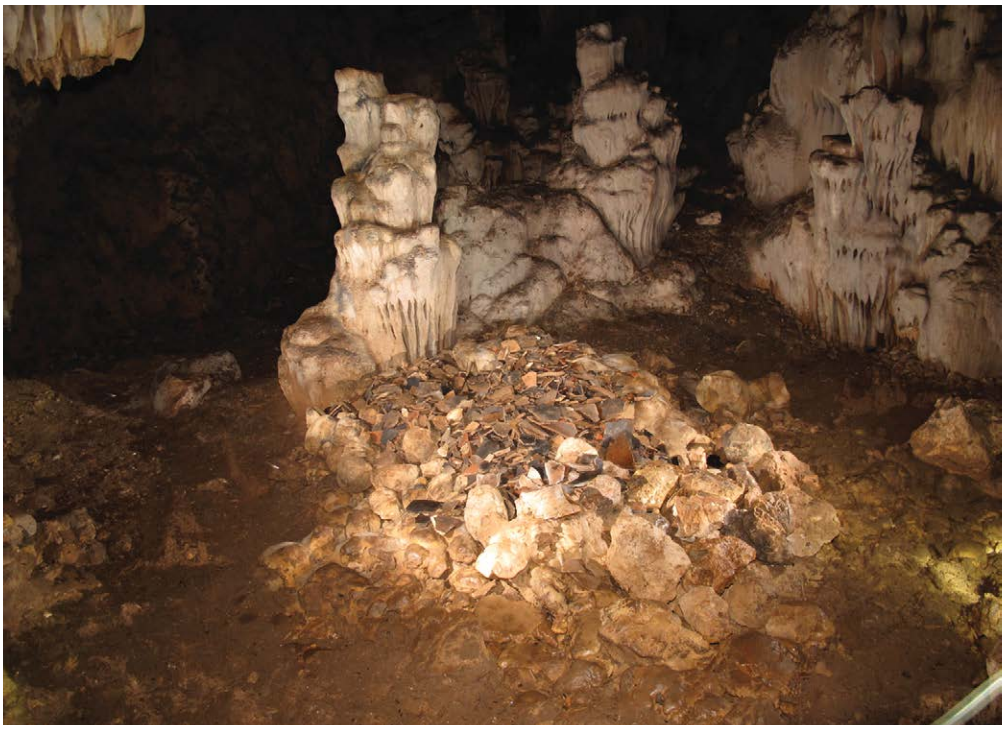

Figure 10.3. Stalagmitic formation cluster and cobble pavement in Actun Lak Chamber 1 (photo by Jon Spenard).

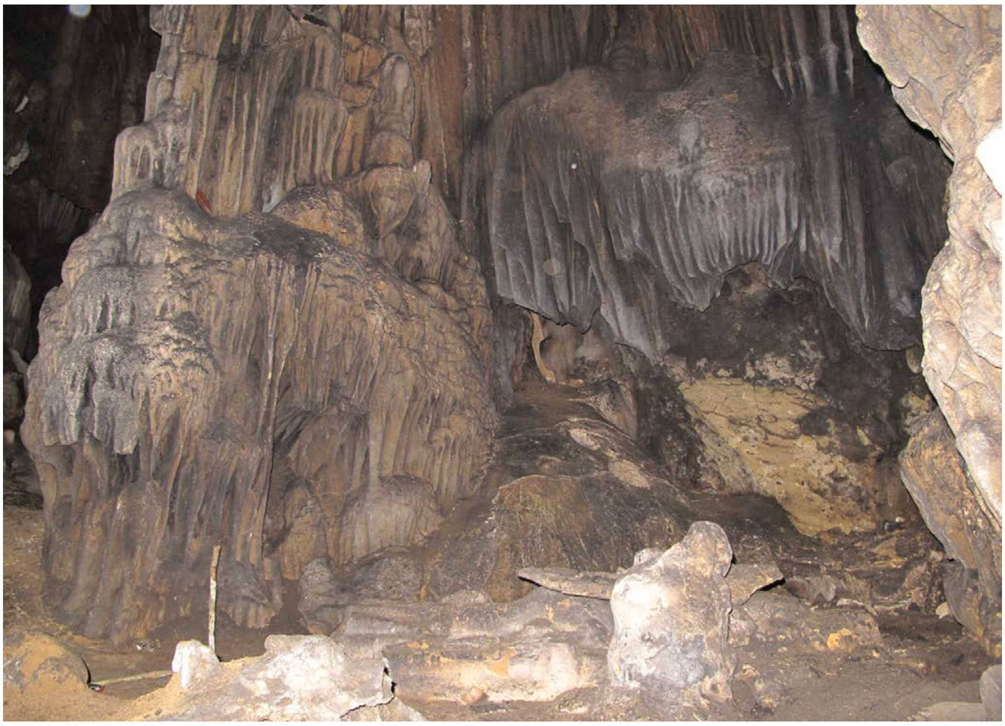

Figure 10.4. Cave formation altar and burned walls in Actun Lak Chamber 2 (photo by Jon Spenard).

the wood from this fire was wet pine, which would have created heavy volumes of smoke. Additionally, the fire was intense and burned hot enough to chemically transform the adjacent walls and floor to quicklime (Spenard 2014). A radiocarbon assay of a partially burned piece of wood returned a date of 770-940 cal AD, the median of which is AD 855, only 35 years later than the earliest appearance of Altar Orange in the greater Peten region (Foias and Bishop 1997:278; Spenard 2014). In addition to an intensive fire, over 100 pieces of greenstone objects were recovered from the foot of the altar. Most are beads of various shapes and sizes, but three pieces of two earspools were also uncovered. By quantity, that cache remains the largest offering of greenstone yet excavated at Pacbitun, including from the richest royal tomb uncovered there (Healy *et al*. 2004b). Taube (2001, 2005) has noted for Classic Maya and other Mesoamerican peoples, jade was closely affiliated with rain-carrying winds, and earspools of the stone were objects worn by the wind god.

Spenard (2014; Spenard *et al*. 2012) has proposed Actun Lak was a primary rain shrine for the Pacbitun community. Rocky Crab Cave is one of only two known landscape drains in the Pacbitun region and the closest to the site. During the rainy season, people would have witnessed the hill filling with water as it poured into the cave. In general, Maya people considered caves and mountains to be the sources of rain and water, thus this hill would have been understood as one of the primary sources of rain for Pacbitun (Taube 2001). The constructions were used to transform the cave from a Late Preclassic through Early Classic period community shrine for individual interactions with the rain gods to a grand performance space used by the highest elites in the Terminal Classic (Spenard 2014; Spenard *et al*. 2012). In short, the earliest ritual activity in Actun Lak was focused on a cluster of stalagmitic formations near the centre of the cave. Offerings were commonly made in small, crude bowls, identified as Hewlett Bank Unslipped type. On the other hand, the Terminal Classic period constructions are located outside or just inside the cave, where the rituals became spectacles for all to see. Use of the altar inside the cave closely overlaps chronologically with the constructions at the entrance, suggesting that the fires burned there, and the offerings made, were part of the same ritual performances. Spenard (2014; Spenard *et al*. 2012) has suggested that the ritual performance included a symbolic auto-sacrifice of Pacbitun's ruler seen in the offering of the greenstone objects, but one that was also indicative of rain-carrying winds. The potency of that offering was enhanced by the burning of the raw wood (see chapter eleven), the smoke of which would have been sufficiently voluminous so that it would have billowed out of the entrance, replicating rain clouds (Taube 2001). The need for such an elaborate spectacle was likely precipitated by a series of multidecadal droughts that struck western Belize in the mid-9th century, the same time period captured by the radiocarbon assay, and Altar Orange bowls indicate the resurgence of rain rituals at Actun Lak (Kennett *et al*. 2012).

The Nohoch Tunich Bedrock Outcrop Complex (NTC)

The Nohoch Tunich Bedrock Outcrop Complex (NTC) emerges from the top of the hill into which Actun Lak and Rocky Crab caves penetrate and is composed of numerous karst features including small caves, rockshelters of varying sizes, cliff faces, and massive boulders. We briefly note that the only navigable path connecting Actun Lak and the NTC was surveyed for cultural remains, particularly ceramic sherds and crude architecture as encountered further downhill, but none were encountered, implying the Maya used the NTC for purposes unrelated to the rain rituals performed at the two caves below. The Pacbitun Maya modified many of the karst features in the NTC with an array of small-scale architectural constructions, and structured deposits dated ceramically to the late Coc through early Canto phases. Although part of one bedrock outcrop, the features are a representative sample of the variety of ceremonial landmarks in the Pacbitun region.

Generally speaking, the architecture found in the various features of the NTC are crude, made of uncut, dry laid stone, and date to the Late Coc and Tzib phases. Elsewhere, Spenard (2017) proposed those modifications were designed specifically to enhance the essence of the place by employing an intentionally crude aesthetic mimicking Maya perceptions of 'nature', as the forest—unruly, unkempt, but beautiful and paradisiacal—diametrically opposed to the measured and straight space of the town or lived space. These modifications may have been made to transform the hilltop into a pleasure-garden like place similar to, but less grandiose, than those commissioned by nobility throughout the Late Postclassic period Basin of Mexico (Evans 2000; Hanks 1990:306-308; Stone 1995; Taube 2004).

Actun Nohoch Tunich

Actun Nohoch Tunich rockshelter is the namesake for the NTC (Figure 10.5). It is 53 m long by 13 m tall and naturally divided into South, Middle, and North sections, with the former being the primary activity area. Generally speaking, its floor is flat and open with a few massive boulders rising above the ground surface. All but one of them is located below the lip of the upper rim of the rockshelter, suggesting they fell from above. The other boulder is a massive spall from the rear wall, which split from the parent rock in such a way that it has a relatively flat, bench-like top.

Our efforts were aimed at the bench-like boulder, in front of which we uncovered an expansive stratified cache spanning at least 5 m long by 2 m wide, reaching bedrock at 1.5 m below the surface and created during a single construction event. After excavating the pit, the Maya placed thousands of *jute* snail shells and chert flakes onto the exposed bedrock, which they subsequently burned. Next, the burned shell-and-flake layer was capped with flat limestone boulders, and then the remainder of the pit was refilled with the originally excavated matrix, mixed with ceramic sherds. The result was completely artificial, yet seemingly 'natural' floor.

Actun Xtuyul

On a small lip directly above Actun Nohoch Tunich is Actun Xtuyul is a small rockshelter opening to the east, and measuring 13 m long, 2 m tall, and no more than 3 m deep. A series of aligned, single course, uncut limestone rock clusters just outside of the dripline create bounded spaces presumably for ritual performances. Ceramic sherds, a large, round-shaped milky quartz pebble, and a modified ceramic production mould fragment were all recovered from this feature. Ceramics date stylistically to the Late

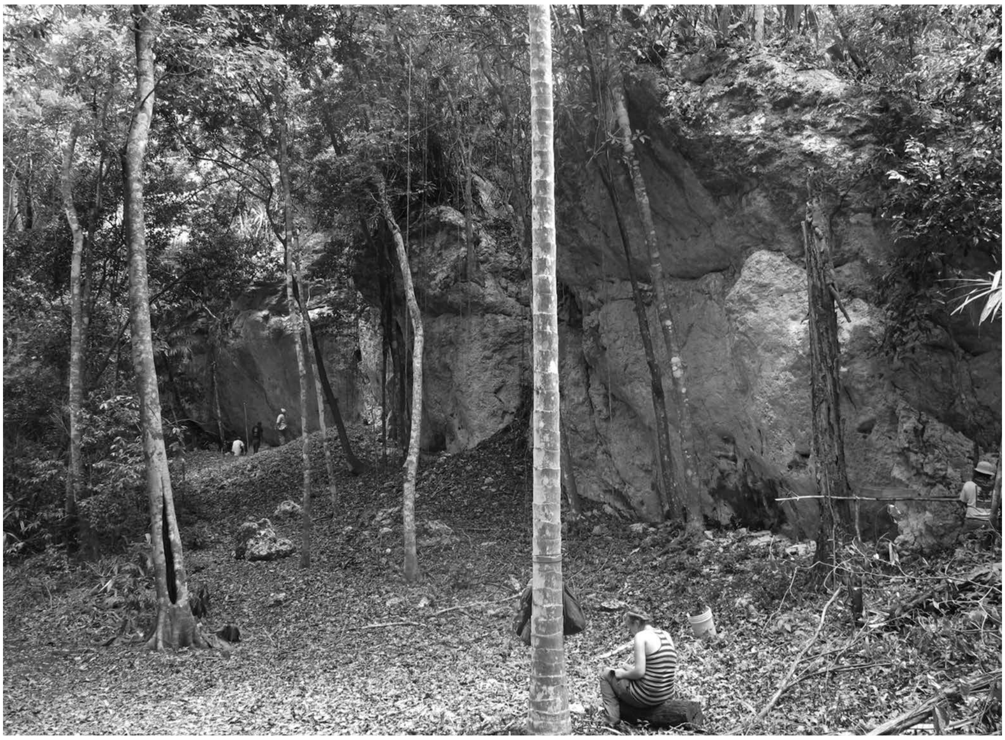

Figure 10.5. Overview photograph of Actun Nohoch Tunic rockshelter. Actun Xtuyul is on the upper lip in the middle of the shelter, above the three individuals in the background (Spenard 2017).

Coc and Tzib phases, but, the only other Hewlett Bank Unslipped sherd recovered outside of Actun Lak Chamber 1 was collected there, suggesting use of the feature began during the Ku phase. The mould is only the fourth of its kind yet recovered anywhere in the Maya region, and it is the largest. It was likely used to produce Sahcaba Molded-carved type vases prior to its final deposition in Actun Xtuyul (Spenard and Helmke 2020). That type of pottery as well as two others closely related to it are a prime marker of the Terminal Classic period in the eastern Maya lowlands, and the vessels were exchanged as gifts in secondary elite contexts, a reflection of their growing political power and the weakening of royal rule (see chapters nine, and sixteen, this volume). Recovery of the mould suggests the secondary elite of Pacbitun were involved in the production of those vessels. Actun Xtuyul also contained the largest variety of species of plants recovered in any feature in the Pacbitun karstscape (see chapter eleven, this volume). That variety included several seeds which, when considering a spherical quartz pebble was also recovered there, may indicate the rock shelter was used for divinatory or day keeping purposes (Spenard 2014).

Actun Subuul

Approximately 40 m southeast of Actun Nohoch Tunich, from which it likely eroded in the deep past, sits the large boulder named Actun Subuul (Figure 10.6). The boulder itself is roughly diamond shaped, and measures 10 m at its widest and longest. Nearly half of the feature consists of an undercut created by a gentle slope in the rear wall. The floor underneath consists of a dry, limestone-pebble filled, 'cave' matrix with ceramic sherds mixed in, sharply distinct from the humic forest floor surrounding it. Although stone architecture was not present, excavations revealed an artefact assemblage similar those found in other karst features. We recovered chert flakes, several hundred *jute* snail shells, imported and unmodified slate rocks, a granite mano placed on top of a cluster of limestone rocks, and ceramic sherds dating primarily to the Late Coc through Tzib phases, although a single Tzul phase Aguila Orange type (Smith and Gifford 1966:154) basal flange bowl fragment was identified. This overlap in assemblages implies the Maya understood the boulder to be a *ch'een* and used it as such.

Actun Ch'e'ehem Zotz

Penetrating the eastern wall of a circular sink depression in the western portion of the NTC is Actun Ch'e'ehem Zotz. A small crack in the bedrock face measuring 0.5 m tall and wide provides access to the cave; however, the pre-Hispanic Maya enhanced that restriction by filling in the portion below the exterior ground surface. Upon entering the cave, a short passage slopes sharply downwards, intersecting the approximate middle of a rectangular-shaped room 4.5 m long by 2.5 m wide and 1 m high. Identifiable ceramics recovered from there all date to the Late Coc through Tzib phases. Even in this small room, two stone constructions were recorded. One is in the southwest corner of the chamber and consists of three imported rocks stacked against an extinct dripstone formation. The other is a terrace platform in the north-eastern corner of the cave, made from uncut limestone blocks.

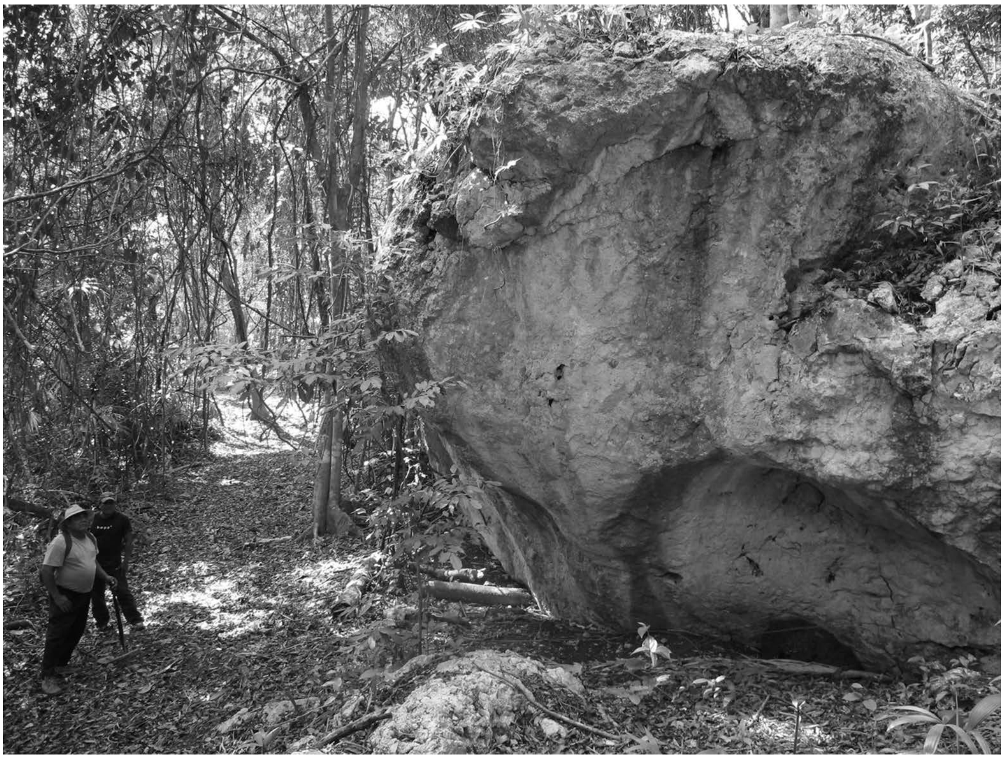

Figure 10.6. Actun Subuul boulder with PRAP project foremen for scale. The pebbly cave-like matrix is beneath the small overhand where the discarded logs have been placed and continues to the bottom right of the image (Spenard 2017).

Javier's Cave

Situated on the crest of the hilltop at the northern most extent of the NTC is Javier's Cave, named in honour of the person who discovered it. The entrance is a 1.5 m tall drop that immediately slopes downward 45 degrees. The interior of the cave is 24 m long, has a maximum ceiling height of 7 m near the entrance, and averages 2 m wide. Our investigations in this cave revealed that, although it is a small feature, the Pacbitun Maya made extensive modifications to it, including constructing ten artificial walls, placing stacks and piles of rocks throughout, and breaking most of the small dripstone formations. Understanding why this feature was so heavily modified remains elusive as the constructions serve no obvious purpose. Four of the walls were erected on the sloping path within the first 6 m of the cave. They are too tall to be effective stairs, and too densely concentrated and too close to the entrance to serve as retaining walls. Moreover, unlike Actun Lak, the interior of the cavern is invisible to people standing outside negating the possibility they were used as performance stages. Three other walls were placed near the rear of the cave where the passage becomes increasingly narrow to the point of being impassable. Another divides an elevated passage in the middle of the cave, and the other two are in the middle of the cavern. Identifiable ceramics, belonging to the Cayo, Dolphin Head, Mount Maloney, and Garbutt Creek Groups (Gifford 1976), date to the Late Coc through Tzib phases, suggesting the modifications, and primary period of use date to those times.

Actun Ku'uk

Located in the centre of the NTC, the roof of Actun Ku'uk had been a natural bridge sometime before the Maya began using it, but its current structural configuration is the result of a massive V-shaped boulder breaking away from the bridge and becoming lodged between the two walls below (Figure 10.7). The space is only large enough for a few people to stand inside in a line. Even though portable artefacts were not visible on the floor, Pacbitun Maya people modified the main chamber with a 1.5 m tall wall of uncut, dry-laid boulders, bounding the south-eastern corner of the chamber. The area beyond the construction slopes sharply upward, suggesting that the terrace may have been built as a retaining wall, but it also sharply delineates interior and exterior spaces.

Overall, two likely possibilities exist for understanding how the Maya used this feature, although they are not necessarily mutually exclusive. Given Actun Ku'uk's central location in the NTC, the constructions may have directed foot traffic through the system, similar to the constructions recorded in the Sibun-Manatee karst in eastern Belize (Kenward 2005:254). The second possibility is that they established a definitive space for ritual performance. Although no dateable artefacts were recovered, the ubiquity of Late Coc through Tzib phase constructions in other areas of the NTC suggests that the architecture in Actun Ku'uk was also built at that time.

Actun Ak Ha

Actun Ak Ha is an 8 m long, 4 m wide, and 3 m tall rockshelter at the western extent of the NTC that formed when a small outcrop toppled over onto another smaller one. Several similar clusters of small outcrops up to 5 m tall are found throughout that area. Actun Ak Ha is at the south-eastern corner of one of these small outcrops, which it shares with two other karst features not discussed in this chapter, Actun Chechem, and Actun Ok Ak Ha. Portable artefacts are absent from the surface, although architecture is present, including a possible limestone pavement on the floor against the smaller, collapsed boulder. Additionally, a terrace or a low bench altar modifies the floor of the western entrance.

The area immediately outside of the western end of Actun Ak Ha is a flat, open space bounded by the large outcrop boulder, and by a cliff and a jutting wall of bedrock. Running between and connecting the two outcrops is a low constructed wall. The jutting wall of bedrock has a large, exposed face with a crack at the bottom, resembling a miniature cave. Directly in front of, and framing the crack are the remains of a small platform, indicating the feature had been the focus of ritual activity in the past (Figure 10.8).

Actun Naj Che

Measuring 30 m east to west, and opening to the south, Actun Naj Che was chosen for investigations because its comparable size, character, and proximity to Actun Nohoch Tunich offered the chance for understanding these types of geologic features from a regional perspective. Three main areas, the Upper, Middle, and Lower Levels, are defined by the feature's topography. The Upper Level contains the least evidence of past cultural activity, with artefacts being absent from the surface and only one or two small architectural modifications noted. Practices affiliated with the Middle Level are so far unique to the Pacbitun karstscape. There, we recovered evidence that Late Coc to Tzib phase Maya people cremated an individual in a pit lined with limestone blocks. Associated with the deceased was an obsidian blade, suggesting blood was shed for a related ceremony. Chert flakes, and *jute* snail shells were also present, and these two classes of artefacts are commonly found together in burials in rockshelters throughout Belize and Guatemala (Glassman and Bonor 2005:286-287; Prufer 2002:225; Spenard 2006; Woodfill 2010). This type of burial is so far unique at Pacbitun and in the karstscape surrounding it, but the presence of those two artefact classes demonstrate the deceased was accorded similar treatment as people interred by other means.

The Lower Level is the largest section of Actun Naj Che, accounting for roughly half of the feature's total area. A constructed stone alignment at the foot of the sloped bedrock outcrop bordering the Middle Level delineates its eastern extent, whereas a large flowstone formation dominates its southern boundary, and a slight rise above

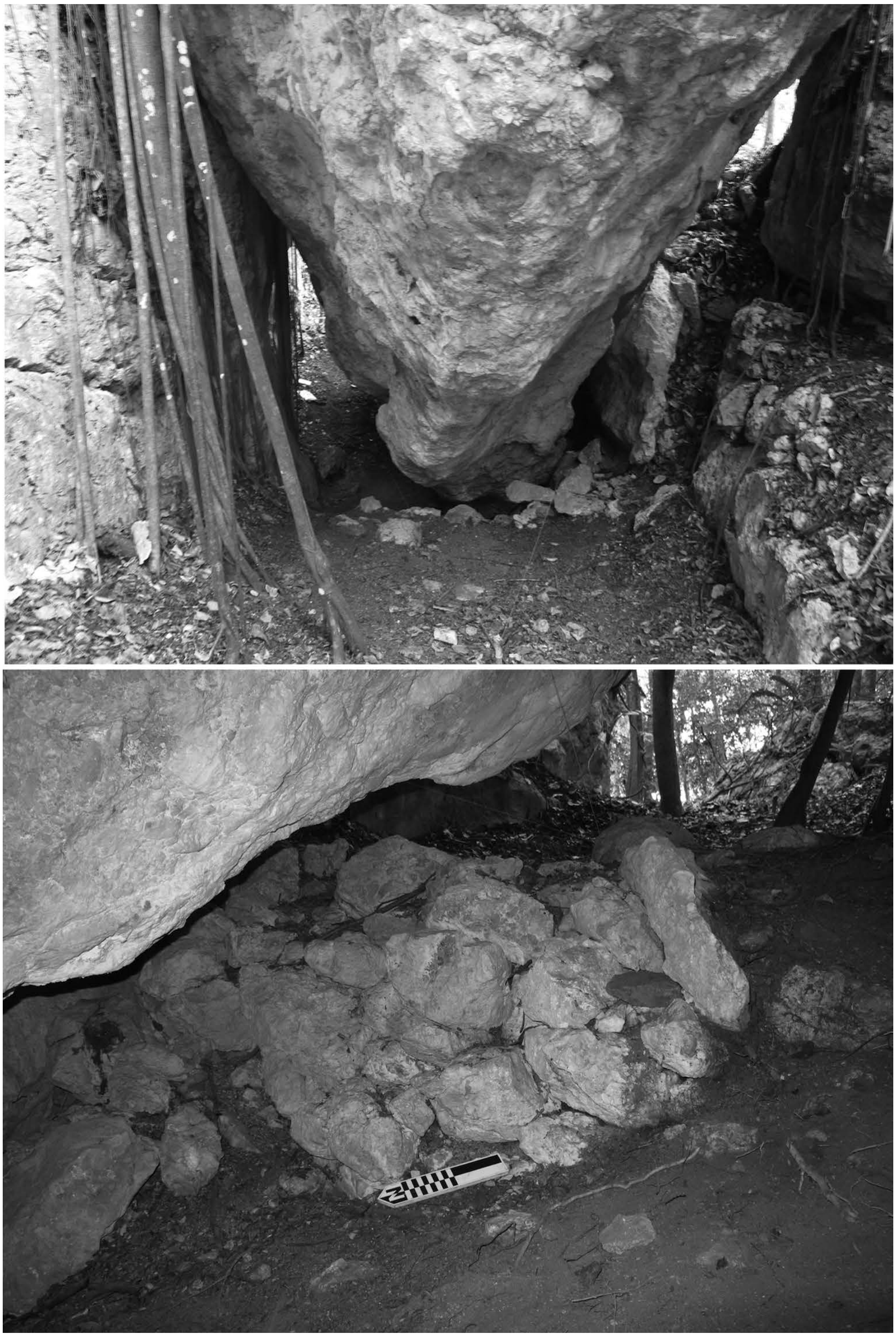

Figure 10.7. Exterior (top) and interior (bottom) views of Actun Ku'uk showing large wall delineating interior and exterior space (photos by Jon Spenard).

the ground outside the dripline defines its western border. Two distinct matrix types further divide this section of the rockshelter. One abuts the rear wall, consisting of a grey, dry, powdery, limestone pebble rich soil. The other is closer to the drip line and is moist dark brown, loosely compacted fine silty matrix with very few natural rock inclusions of any sort.

Excavations within the latter matrix revealed at least three rock alignments, the top two between 0.3 and 0.5 m below the current ground surface, and the final one nearly 1 m down. The top wall was arranged north-south on top of which was placed a granite mano. The lower wall ran east-west, while the lowest cluster of rocks capped culturally sterile soil. Time did not permit for horizontal excavations of the area, but the presence of the buried walls indicates the current ground surface was a purposefully designed by the Maya, much in the same way that the area in front of the flat boulder in Actun Nohoch Tunich was, to construct or augment a natural space.

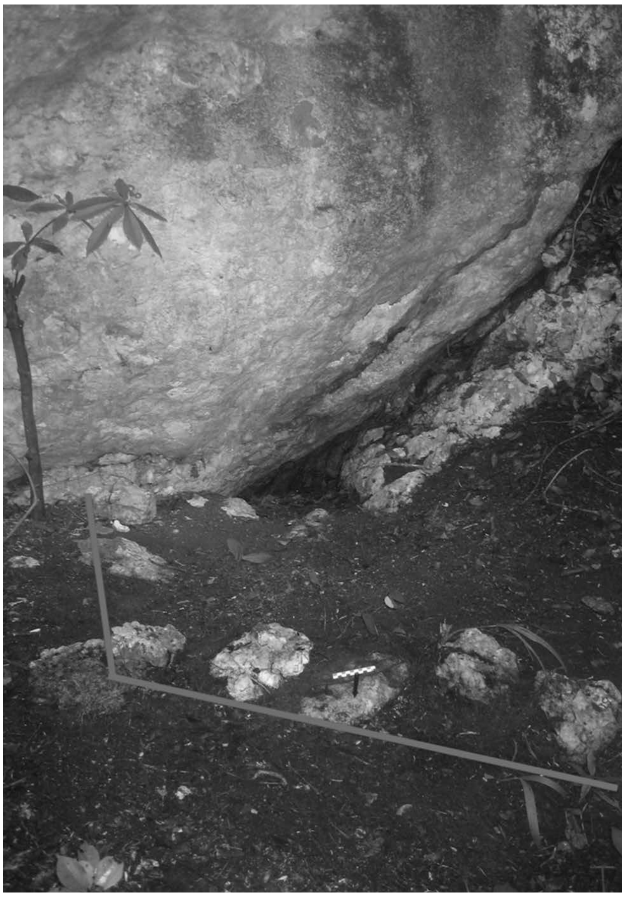

Figure 10.8. Unnamed cracked bedrock outcrop near Actun Ak Ha, in front of which the Maya constructed a single-course rock frame, delineating it as a special space (photo by Mike Mirro).

Phase II Investigations: Crystal Palace, Tzul's Cave, and Slate Cave

In this section, we discuss three landmarks that were the primary foci of investigations during our Phase II research, Crystal Palace, Tzul's Cave, and Slate Cave. Crystal Palace is south of Pacbitun, and the other two are on opposite hillsides of a creek bank to the southwest of that site. The former was selected for investigation because it contained an unusually high number of architectural terraces at its entrance, dense ceramic clusters, and evidence of small-scale burning activities throughout, all suggesting it was a major ritual location for Pacbitun Maya peoples. Tzul's cave was selected for investigations because it is one of the few karst features in the Pacbitun karstscape with an intact, or nearly so, artefact assemblage. This cave was discovered on private property in the early 1990s and a locked, iron gate was constructed over its entrance soon after. Dozens of complete or nearly complete vessels remain inside and evidence of subsurface looting is absent. Slate Cave was first documented by the PRAP in 2010 and was selected for investigations because it contains the only known parietal art in the Pacbitun region, a series of simple faces, geometric designs, and an anthropomorphic figure that may be a spider monkey, or a boxer (Spenard 2011, 2014; Spenard and Mirro 2017; Taube 2018). Slate and Tzul's caves were also selected for investigations because they are at the head of a valley leading to the most complex cave network and largest landscape drain in the Pacbitun region. There, on top of an isolated, steeply sloped hill is the minor centre of Sak Pol Pak which has the tallest pyramidal structure in the region outside of Pacbitun's Structure 1 (Conlon 1999; Spenard *et al.* 2012). During the Coc phase, the Pacbitun Maya constructed a causeway several kilometres long running from that site to the head of the valley, suggesting it was a place of royal and perhaps rain rituals, similar to Actun Lak (Weber 2011). Here we only describe the two caves, leaving the analysis to Weber and Spenard (see chapter thirteen, this volume).

Crystal Palace

Crystal Palace is an ovular-shaped sinkhole 63 m long by 25 m at it widest, with ceilings that range from 1.5 m tall at the entrance and in small side passages to 8 m tall at its rear (Figure 10.9). With six chambers, each separated by large collapse boulders or walls of columnar formations it is more open and gallery like than many of the other caves described in this chapter, and many of the architectural modifications made within appear to have been designed to take advantage of that characteristic. The cobble strewn entrance slopes sharply downward, beyond which ceiling breakdown boulders separated by walls of columnar and stalactite formation create massive stepped terraces toward the back of the cave. Most of the floor beyond the sloped entrance is covered in thick, wet mud, and modern disturbance to the archaeological remains can be seen throughout the cave. Few surface artefacts remain, but several modern stacks of Late Coc through Tzib phase ceramics belonging to the Cayo, Dolphin Head, Mount Maloney Groups (Gifford 1976) and Tepeu 2/3 Peten Gloss wares (Smith and Gifford 1966) have been placed on low-lying ledges and cave formations throughout. The few known areas where artefact assemblages remain intact are two sub chambers in a restricted part of the cave, a small ledge and two pits discovered in 2016. The assemblages of the sub chambers largely consist of Late Coc through Tzib phase jars and dishes, most with fresh breaks. On the ledge, we recorded five complete bowls of the same unknown type arranged in cruciform pattern, perhaps replicating the ordered five-directional cosmos (Mathews and Garber 2004). All were lightly cemented into place over the millennia by the light splashing of water dripping from formations in the ceiling above. They were otherwise empty save for a thin film of mud coating the interior of four. The other had a thick coat of calcium carbonate and two formations beginning to grow inside of it. The bowl furthest to the east has a single greenstone bead placed beneath it. One of the pits lacked cultural material, but the other contained the defleshed, articulated, flexed leg of a deer (Norbert Stanchly, personal communication, 2017). Deer haunches are commonly depicted in Maya art and discussed in hieroglyphic texts in ritual and feasting contexts, including as ritual offerings during hunting ceremonies and in New Year celebrations (Looper 2019:41).

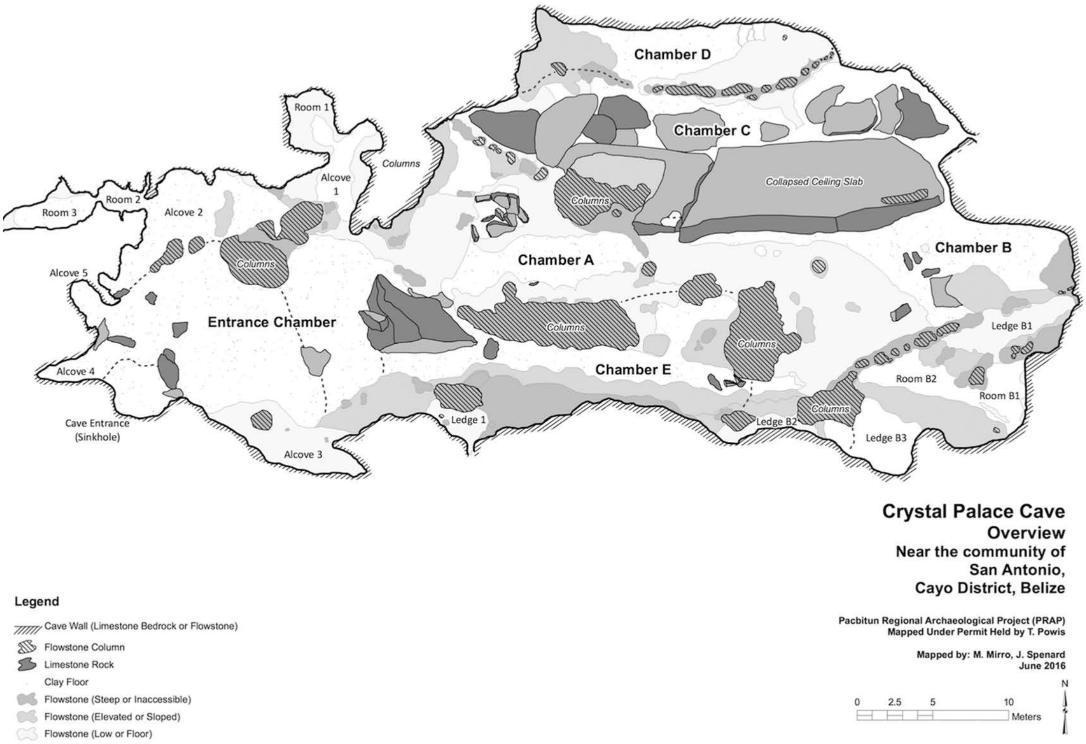

Figure 10.9. Overview map of Crystal Palace cave (Spenard *et al.* 2018).

Although few portable artefacts are present, evidence that this cave was used extensively abounds. Over 200 archaeological features were recorded, and many more likely exist as our efforts were limited to the easily accessible, open areas of the cave. Those features can be generally categorised as: walls; tall platforms, terraces; charcoal and ash deposits; artificial floors of imported stones and pebbles; triangular arrangements of cave formations and rocks on ledges likely used as pot stands; delineated pathways on slopes made from small terraces; delineated pathways in flat areas made from broken cave formations filling uneven areas; blocked openings and passages; harvested cave formations; cave formations modified through percussive force; ceramic piles/clusters (non-modern); speleothem clusters; rock clusters; speleothem and rock clusters; and cut and levelled mud floors. Distribution and chronological patterns are difficult to determine for the different classes of features because of the general lack of datable artefacts, and because the intensity to which the cave was modified. Yet, many of the spaces produced by the stone modifications in particular were small, likely to be used by one or a few individuals for private ceremonies, rather than for large public spectacles.

Tzul's Cave

Located 2.5 kms from Pacbitun, Tzul's Cave appears to be a small, restricted cavern consisting of three horizontal tube-like passages connected to one another by vertical drops, yet its true size remains unknown (Figure 10.10). We selected this cave for study because of its size and the extent of modifications made to it, and because the causeway leading to Pacbitun terminates nearby, and a small plaza group has been recorded just south of it, suggesting the cavern may have been an elite ritual space (see chapter thirteen, this volume; Weber 2011).

The one known entrance to the cavern is located just inside a small alcove penetrating a bedrock outcrop jutting up from a natural bench on a gently sloping hillside. Immediately inside the entrance, the floor of the alcove drops 4 m into a northeast-southwest running chamber below. That chamber, Room A, measures 10 m long, has an average ceiling height of 4 m, and is narrow, measuring no more than 3 m wide. The floor is bedrock, and save for systematically harvested stalactites, no evidence of Maya use of this part of the cave has been recovered.

The cave continues to the northeast where the 3 m long Room C is accessed by a short, down-sloping, 1 m high passage (Room B) continuing under the entrance of the cavern. The passage had been artificially restricted in the past with a cobble wall, since torn down. The eastern and northern walls of the room all skirt the outer edges of the bedrock outcrop into which the cave penetrates, and all the small openings have been infilled with rubble, transforming the once airy and lit room into a dark cave. The floor in Chamber C has been artificially levelled, raised as much as 1 m high at the north end, but the ceiling there is low averaging 1.5 m high. At about 1.5 m wide, the chamber is also very narrow. A small alcove holding a cluster of broken jar rims and large pieces of slate intermixed with limestone cobbles is present along the western wall of the chamber. At the northern most end of the alcove the floor levelling stops abruptly, leaving a glaring hole in the cave

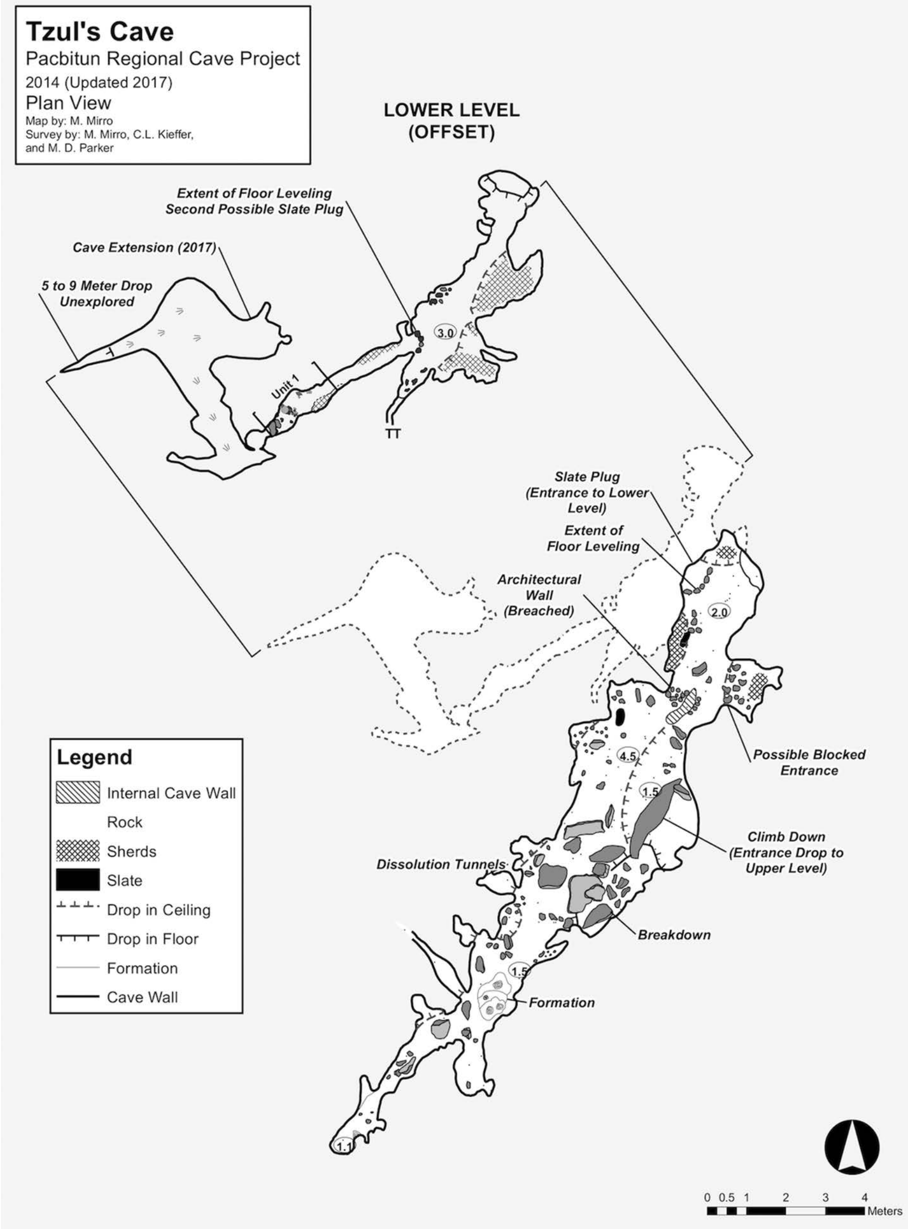
Tzul's Cave
Pacbitun Regional Cave Project
2014 (Updated 2017)
Plan View
Map by: M. Mirro
Survey by: M. Mirro, C.L. Kieffer, and M. D. Parker
LOWER LEVEL (OFFSET)
Extent of Floor Leveling Second Possible Slate Plug
Cave Extension (2017)
5 to 9 Meter Drop Unexplored
Unit 1
3.0
Slate Plug (Entrance to Lower Level)
Extent of Floor Leveling
Architectural Wall (Breached)
2.0
Possible Blocked Entrance
4.5
1.5
Climb Down (Entrance Drop to Upper Level)
Dissolution Tunnels
Breakdown
1.5
Formation
1.1
Legend
Internal Cave Wall
Rock
Sherds
Slate
Drop in Ceiling
Drop in Floor
Formation
Cave Wall
0 0.5 1 2 3 4
Meters

Figure 10.10. Map of Tzul's cave.

floor that had been covered over in the past by a slate block plastered into place.

The slate plug capped a vertical drop of 3 m providing access to Rooms D, E, and F. Room D is the largest known in the lower level of the cave, and is aligned north to south, while Room E, is a small alcove at its northern end. Together, they measure 6.5 m long and average 1.5 m wide. Few artefacts are present directly below the drop and in the main access ways of the chamber, but an alcove beneath the entrance ledge connecting with Room E contains several whole and partial vessels, including the remains of approximately 15 jars, and fewer than six bowls/dishes, stylistically dated to the Late Coc through Tzib phases. At least 20 cm of soil and hundreds of kilograms of large rocks had been imported into Rooms D and E to level the floor. Ceramics mixed in with the matrix and between the boulders indicates it cultural origins.

Room F is a downward sloping finger-like passage extending from the southwest corner of Room D, measuring 4 m long, and 0.5 m wide and tall. The Maya had blocked its entrance with a triangular-shaped slate plug that had been plastered into place similar to the other found above in Room C, although it was removed prior to our investigations. Ledges covered in Late Coc through Tzib phase pottery line the edges of Room F. The cave appears to terminate at the back of this room where the ceiling slopes downward to meet the slightly inclining floor. Yet, there too, the Maya had artificially raised the floor by importing hundreds of fist-sized rocks, which they then covered in over 20 cm of mud. Those efforts were for blocking a small passage that continues further into the cave. That the passage was intentionally blocked is unquestionable. Approximately 15 cm below the surface the Maya had placed a stack of black-slipped jar shards topped with a ceramic disc 17 cm in diameter. Charcoal was intermixed with the cache.

Beyond the blocked passage, the cave continues after an extremely tight passage to another room slightly larger than Room D, and then to a sloping passage that ends in a deep drop that required rope to descend. No artefacts were present beyond the blocked passage and given time constraints and lack of proper equipment to continue we ended our explorations of this part of the cave; however, it is similar in character to another cave we located on the other side of the hill Tzul's Cave penetrates but have yet to explore.

Overall, Tzul's Cave is a highly significant feature in the Pacbitun karstscape. As mentioned above, the causeway connecting the valley to Pacbitun's epicentre suggests the elite of that site were likely performing rituals there during the final two centuries of the Late Classic period (see chapter thirteen, this volume). The purpose of the rituals performed in Tzul's Cave remains unclear; however, significant energy was expended modifying it during the late Coc through Tzib phases. Most of this energy was used importing and hauling in highly cramped conditions, sufficient quantities of limestone cobbles and mud to raise floors, and block passages and natural windows to the outside.

Slate Cave

Slate Cave is a 55 m long dry cave located uphill from the western bank of a seasonally active waterway. There are two main areas of the cavern, naturally separated by a tight squeeze. The entrance area is a uniform, gently inclining tube running east-west for 10 m, then it turns to the southwest for another 20 m (Figure 10.11). A small 2 m long belly-crawl provides access to the second half of the cave which runs north-south for 15 m. The floor of the entire cave is composed of clay-like soil, but the character of the two areas vary greatly. The front section is relatively open with smooth walls; those in the back half are craggy and more Swiss cheese-like. Artefacts were noted in both areas of the cave, although they were found in greater quantities in the front portion. Based on ceramic styles, this cave was first used in the Tzul phase, and continued through the end of the Tzib phase.

Unlike most other karst features discussed in this chapter, few architectural modifications were made to the cave. The only noticeable exception being two boulders used to connect the walls of a buried dissolution pocket, creating a small, enclosed semi-circular space. The most extensive modification is a heavy concentration of imported limestone boulders and rocks carpeting the floor of a 5 m long section of the front part of the cave called, 'The Crawl' after its low, 0.4 m tall ceiling. Some sherds and modified slate blocks were noted in this area.

The two notable features of this cave are a petroglyph panel just inside the entrance, and a possible burial or cache with human remains in an alcove at the furthest extent of the light zone where the passage turns to the southwest. Carved into a seasonally-active flowstone formation 2.5 m above

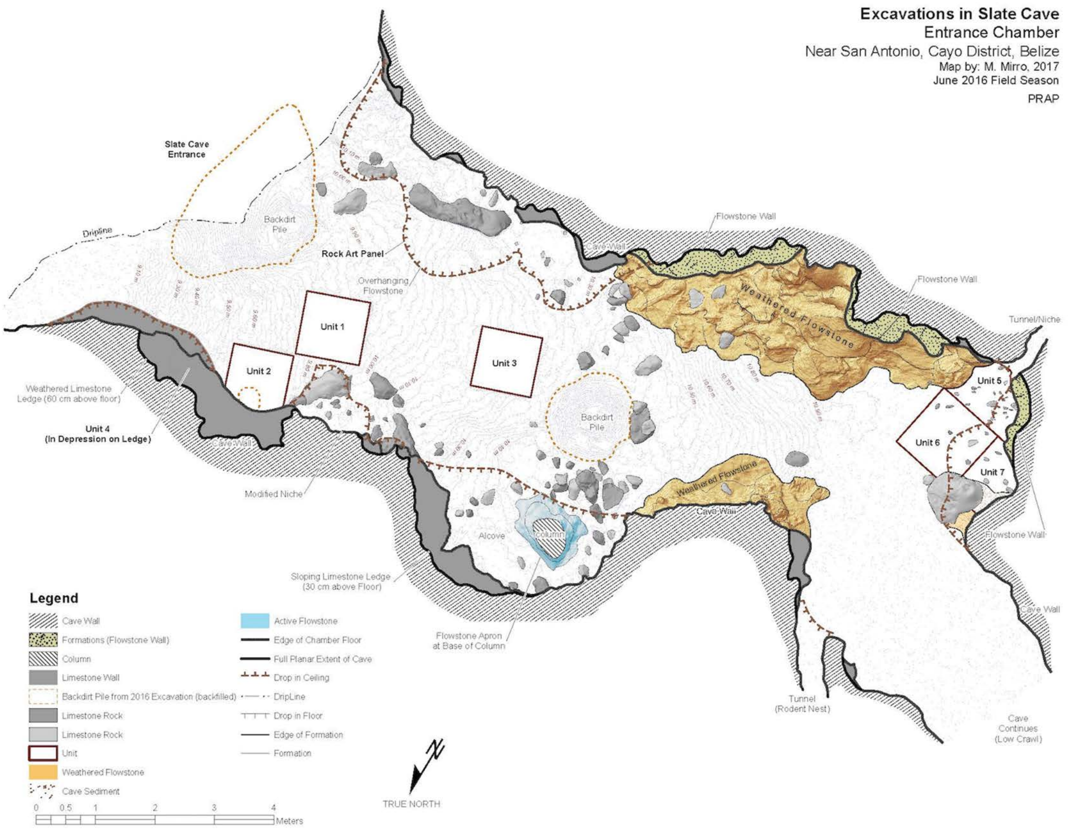

Figure 10.11. Slate Cave Entrance Area map produced from 3D model.

the ground and in the cave's entrance, the petroglyph panel consists of six simple faces (round eyes and bar mouths), geometric shapes, and a full-figure anthropomorphic character, either a spider monkey, or ritual boxer (Taube 2018). Simple carved faces have been recorded on cave walls throughout the Maya area, and they appear on stelae in the Belize Valley in both settlement and cave settings (Awe and Helmke 2005; Awe et. al. 1998; Bonor 1989; Brady 1999; Helmke and Awe 1998; Rissolo 2003; Slater 2014; Stone 1995). While dating of parietal art is notoriously difficult, especially such crude faces, they are commonly found in contexts with significant Late to Terminal Classic period facets, suggesting they may have been created during those times. Regardless of when they were created, they are typically found near water and in burial contexts (Bonor 1989).

Eight metres beyond the petroglyphic panel is a low, double alcove underneath which the Pacbitun Maya excavated a roughly ovular shaped pit approximately 2 m long by 1 m wide and 0.25 m deep. At the bottom of that larger pit, they excavated a smaller hole 1.5 m long by 0.5 m wide and an additional 0.25 m deep to bedrock. Few artefacts were recovered in the larger pit, but a flowstone block, and slate cobble pavement covered the lower hole. At the northern most end of the pavement was a single undecorated jar body sherd. The rocks in the southern half of the pit were in a state of general disarray, but those to the north were ordered and laying close to horizontally flat. These varying conditions of the cobbles suggests the southern side of the pit was excavated in the past and whatever objects originally deposited in there removed, yet it seems this was done with some care as the pit was refilled and the cobbles laid back down close to their original depth, and the entire pavement was reburied.

The northern side of the pit contained a wide array of artefacts. Almost directly below the ceramic sherd was a human cranium with articulated mandible placed on its side, facing west. At least six mammal bone tubes and other bone objects too friable to handle were clustered around the face and chin area of the cranium, with another two located at the base of the occipital bone (Figure 10.12). Four had been carved with horizontal liner incisions encircling the tubes, or x-shaped designs. The two others are uncarved. The tube with the x-shaped incisions was standing nearly upright when first uncovered and the top of it was capped with a large chert flake, one of the few non-bone artefacts recovered in the smaller pit.

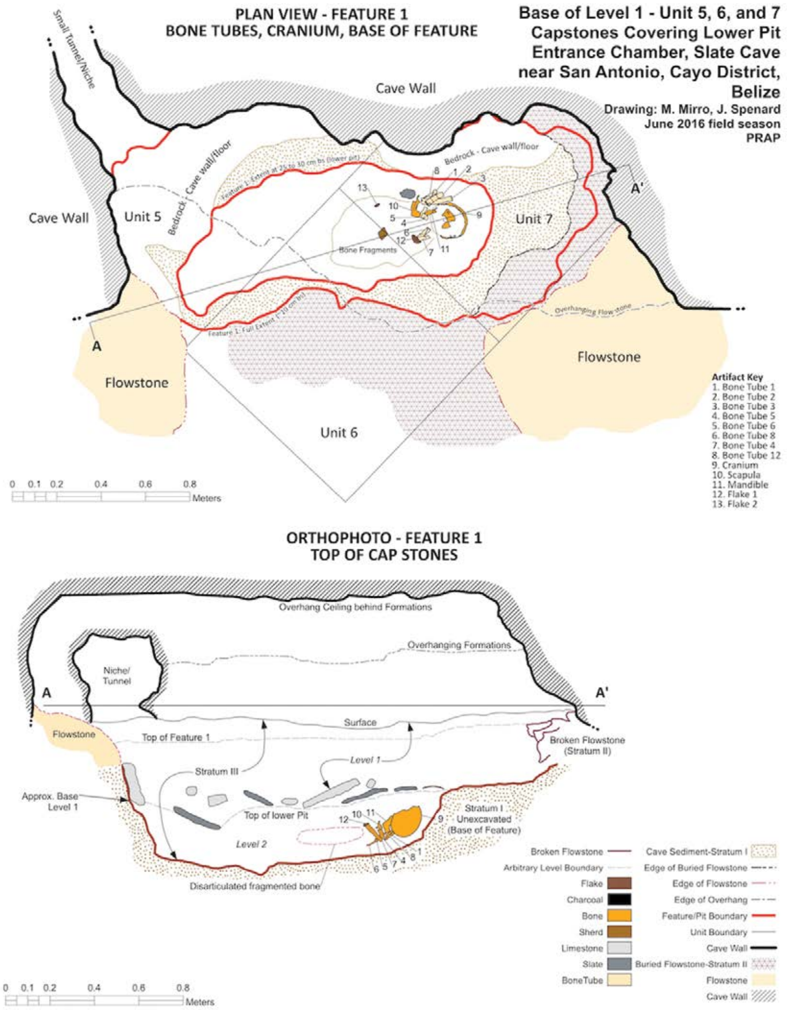

Figure 10.12. Plan and profile views of double pit excavated in double alcove in Slate cave. Produced from 3D model.

Bone tubes have been found throughout the Maya lowlands in both settlement and cave contexts, including Pacbitun (Brady 1989:277; Healy *et al*. 2004b; Willey 1978; Willey *et al*. 1965:494-499). The tubes recovered at these sites were made from either bird or large mammal bones, but few were recovered associated with human remains, and most were fragmentary making identifying how they were used difficult. Yet, they often vary in size, leading archaeologists to speculate they formed panpipes (Healy *et al*. 2004b:231). Although the Slate Cave bone tubes may have been used in this fashion, their apertures are nearly 3 cm wide, likely too large to be useable as wind instruments. Another possible use for these tubes may have been to administer hallucinogenic enemas, a practice common to pre-Hispanic Mesoamerica, but that has not been well tested in the archaeological record (see chapter twelve, this volume; Rubio and Taube 1987; Spenard and Mirro 2017).

Cave Ceramics from a Broad Perspective

In this section, we make a call for ceramicists and archaeologists in general to increase their incorporation of 'cave' pottery into constructions of ceramic assemblages and broader questions related to the Maya. For example, Brady (2005) has calculated that roughly 10 to 15 percent of the total ceramic assemblage produced at Petexbatun sites were ultimately deposited in the caves there. Undoubtedly, the sheer number of vessels being used for cave rituals would have made a significant impact on the ceramic economy. Although we have not done similar calculations at Pacbitun, the quantity of pottery recovered daily in the *ch'eenob* from our 1 m by 1 m excavation units often far surpassed the material coming out of the large-scale horizontal clearing operations conducted in the settlement, indicating there too, karstscape rituals made a significant impact on the local ceramic economy.

We have also been able to better understand Pacbitun's external socio-political relationships in the Late Classic period with the pottery we recovered from our investigations in the karstscape. Most ceramics recovered reveal close cultural ties with the Belize Valley. These findings help clarify Pacbitun's position within the Late Classic period socio-political dynamics of the Belize Valley and the greater Peten region, which continues to be debated (see chapter seventeen, this volume). For example, one scenario suggests that the site was conquered and became the northern most extent of the Caracol polity as evidenced by agricultural practices, burial patterns, ceramic styles, and hieroglyphic evidence (Chase 2004:330; Helmke and Awe 2012). Another proposes that Pacbitun was clearly affiliated with central Belize Valley centres based on the lack of Mount Maloney Black pottery and prevalence of red-slipped carbonate tempered bowls in the ceramic assemblage recovered from a portion of the settlement excavations there (Connell 2010). A third submits that the ceramic assemblage from Pacbitun's palace structure is a regional subcomplex of the Naranjo sphere, and thus it was a secondary centre of that polity (Ball 1993:255). What these three models have in common is the archaeologists formulating them work at sites other than Pacbitun, and they developed them based only on published data, which is problematic because the assemblage has never been described in full. Nevertheless, researchers at Pacbitun have employed ceramic and burial pattern data, and invoked geographic proximity, suggesting instead that the site was affiliated primarily with the Belize Valley during the Late Classic period, and have speculated that it was politically associated with Xunantunich (Ashmore 2010; Healy *et al*. 2004a:225). Direct evidence for that latter scenario has heretofore been lacking (Healy *et al*. 2004a:225).

Xunantunich was closely affiliated with Naranjo, and the ruling lineages from that latter site regularly warred with those of Caracol in the Late Classic period (see chapter nine, this volume; Ashmore 2010; Helmke *et al*. 2010; Martin and Grube 2008). Logic suggests that if Pacbitun was on the frontier, but part of the Caracol polity, then its interactions with Naranjo and affiliated Belize Valley sites should tend towards indifference or hostility, which would be expressed in part by a lack of shared traits and practices, and the presence of defensive architecture. Alternatively, if it were included in the Naranjo-Belize Valley sphere of influence then interactions with affiliated sites should be expressed in shared traits such as ceramics (Ball 1993:255).

Undoubtedly, Pacbitun was involved in warfare events in the Classic period although with which other polities remains uncertain (see chapter nine, this volume). The karstscape ceramics indicate strong ties to the Belize Valley throughout its period of use, and, more specifically, with the Xunantunich polity in the Late Classic as evidenced by the regular occurrence of the Mount Maloney ceramic Group (Connell 2010; LeCount 1996, 2010a, 2010b; LeCount *et al*. 2002; Yaeger 2000:125). Mount Maloney pottery is particularly noteworthy because it is closely affiliated with Xunantunich, relatively geographically constrained to the west of the Macal River, and communities that wanted to demonstrate affiliations with it began using those ceramics regularly (Connell 2010; LeCount 1999, 2010a, 2010b). Overall, these findings reinforce models that have posited strong connections between Pacbitun, the Belize Valley, and Naranjo while challenging those that see close affiliations between it and Caracol (see chapters nine and seventeen, this volume), yet it has so far only been realised through the analysis of the karstscape ceramics.

Conclusions

We documented many more karst features than discussed here, and undoubtedly, we only know of a small portion of those in the greater Pacbitun region. Even so, what we have learned is that Maya people from that site began using only a few of the features around the transition from the Puc through Ku phases. That number steadily increased until all investigated features in the karstscape were in use by the Tzib phase. Although Pacbitun appears to have been abandoned around AD 900, several of the features investigated during Phase I revealed small quantities of Canto phase pottery, indicating the region was not completely depopulated (see discussion of Structure 29 in chapter six, this volume). Moreover, we see that the Pacbitun Maya heavily modified their karstscape for ritual purposes through the construction of large and small platforms, terraces and stairs, they created structured deposits and blocked passages completely or at times seemingly only to make them more difficult to pass through. Collectively, these features were crudely made from dry-laid uncut stone, which appears to have been an aesthetic decision to maintain their wilderness essence. Our evidence also indicates public and private water-related rituals were conducted in some of the features, but for most, especially the diminutive features, their uses remain unclear. We have solid indications that several of the features came to be used or controlled by elites in the Late Coc through Tzib phases, especially Actun Lak, and Rocky Crab, and likely Tzul's and Slate caves, yet the sheer volume of modifications and small ritual stages made during those two centuries throughout the karstscape strongly suggest all members of the Pacbitun community were using them. Unfortunately, evidence for the social status of ritual participants and actors outside those times remains ambiguous.

Much more work remains to be done in the Pacbitun karstscape. The features discussed in this chapter are in the first range of foothills of the Maya Mountains rising just south of Pacbitun. Although not discussed, we have documented the presence of several karst features beyond that ridge, and local hunters know of many more that exist. Given the range of landmarks we documented being used as *ch'een* around Pacbitun, it is likely that hundreds, if not thousands more await to be studied in the region.

Acknowledgements

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11

Ritual Plant Use in Pacbitun's Caves: A Social Paleoethnobotanical Approach

Megan D. Parker and Jon Spenard

The Pacbitun Maya resided in a region of rich biological diversity. The site's position in an ecotone between the Belize River Valley and the Mountain Pine Ridge provided residents with access to a wide variety of botanical species used for subsistence, medicine, economic exchange, and ritual. As prominent loci of ritual ceremony and practice, caves and other similar karst features provide ideal contexts in which to investigate religious plant use among members of the Pacbitun community. Paleoethnobotanical investigations of karst features in the site periphery yielded evidence to suggest that the burning of wood from symbolically significant tree species played a prominent role in ritual cave use. Depictions of sacred trees in Maya iconography and analogies with ethnographic case studies support these interpretations. The burning of wood in cave rituals was a widespread religious practice that all members of Pacbitun's society participated in. Nonetheless, the distribution of particular species of trees used across these landmarks also provide insight into the ways in which such community ritual practices intersected with political power and the ritual economy.

We adopt a social paleoethnobotanical perspective to address ritual plant use among the Pacbitun Maya. Such an approach moves beyond the traditional focus of using archaeobotanical data for reconstructing subsistence and ecology by emphasizing questions related to all aspects of human culture—the social, economic, political, and religious—in the same manner as any other type of artefact (Morehart and Morell-Hart 2015). Adopting this approach at Pacbitun is an opportunity to demonstrate that while a centralised religious authority controlled some aspects of karst landmark rituals during the Classic period, they did so only through the appropriation of domestic practices related to ancestor worship, rain, and fertility (Brady and Prufer 2005).

While some sites included in this study suggest greater centralised control than others, in this chapter, we do not divide such sites into dichotomous categories such as 'elite use' or 'commoner use.' Rather, we use paleoethnobotanical data to make inferences about the relationship between religious authority and the spiritual needs of the Pacbitun community. Certainly, Maya rulers appropriated and controlled ritual goods and practices to reinforce their privilege and authority (Brown *et al.* 2018; Demarest 1992; Friedel 1992; Lucero 2003; Schele and Friedel 1990; Spenard 2014). Indeed, there is evidence to suggest that the appropriation of powerful symbols of the karstscape was a means of rendering the social distinctions present within society (Brady 2000:129-130; Halperin 2005; Lucero 2008). As sources of both sacred and social power, caves could be used to legitimate noble authority (Brady 1997; Brady and Ashmore 1999; Halperin 2005). However, such an act placed significant responsibility on elites to continue to provide physical and spiritual resources for the community (Lucero and Kinkella 2015:164). Religious beliefs and practices originate among commoners and these domestic ideologies become integrated into the political economy by social aggrandizers who seek to establish dominance by merging religion into state-sanctioned ideologies (Lucero 2003, 2006, 2010:139; Lucero and Kinkella 2015; Schele and Friedel 1990; Schele and Miller 1986; Thompson 1970).

By comparing paleoethnobotanical data recovered from eight karst sites around Pacbitun, we can begin to identify the ways in which the plants used in subterranean rituals reflect the participation of different social actors. The presence of pine wood in all of the karst sites suggest that this type of wood was part of a required ritual toolkit (Morehart *et al.* 2005). Pine appears to move through the same exchange networks as other prestige goods, suggesting some level of ritual control by elites (Lentz *et al.* 2005; Morehart *et al.* 2005). However, the paleoethnobotanical assemblages of these karst sites also demonstrate a vast array of other types of wood used not only within, but between them.

There are two potential explanations for the diversity of tree species recovered from the Pacbitun karstscape, although they are not necessarily mutually exclusive. The various botanical species present could indicate the use of easily obtained types of woods that were imbued with symbolic and social meaning depending on the ritual participant's social position and lived experiences (Brown 2004). The wood of particular trees may have had symbolic religious meanings that made them desirable ritual objects within the Pacbitun community. However, we also suggest that the wood of certain trees was associated with ancestors, and that by burning these products in cave ceremonies the people of Pacbitun were calling upon sacred forebears to act as intermediaries between the living and the divine.

Paleoethnobotanical Investigations

During PRAP's 2012 field season, Parker (2013, 2014) initiated a series of paleoethnobotanical investigations complementing the investigations of the karstscape being conducted by Spenard (see chapter ten, this volume;

Spenard 2014, 2017; Spenard and Powis 2014). Soil samples were taken from eight karst features—two rockshelters and six caves—to recover macrobotanical data related to ritual practice. The sites included in this study are: Actun Nohoch Tunich, Actun Xtuyul, Slate Cave, Crystal Palace Cave, Actun Merech, Actun Pech, Tzul's Cave, and Actun Lak. We provide minimal descriptions of the karst features here, for full accounts of each, see chapter ten, this volume.

Methods

Soil samples were taken from, or near, other cultural features such as ceramic caches, burn features, or human remains. These soils were processed in the field using a manual flotation method and exported to the environmental anthropology laboratory at Georgia State University for analysis. Charcoal was initially sorted using low-power microscopy and identified using a scanning electron microscope. Angiosperm dicot (hardwood) charcoal was compared to photomicrographs of structural wood anatomy accessed through the North Carolina State University online database, Inside Wood (Wheeler 2011). Pine charcoal was identified based on the presence of distinctive resin ducts because it is the only species of gymnosperm (softwood) indigenous to the region. Since samples were collected opportunistically, direct quantitative comparisons between cave sites cannot be made. However, the data complement each other, and can be used to demonstrate certain behavioural patterns in Maya cave ritual.

Results and Discussion

Overall, few food remains were recovered from any of the sites, although wood charcoal from edible tree species were identified. The majority of the paleoethnobotanical data consisted of carbonised wood charcoal (Figure 11.1; Table 11.1). Previous paleoethnobotanical cave investigations conducted in the Belize River Valley yielded significant evidence of ritual food offerings, but also noted the presence of mostly wood charcoal in ritual deposits (Morehart 2011; Morehart *et al*. 2005). While it is tempting to dismiss this wood charcoal as simply a source of fuel, a consideration of the symbolism associated with trees and the specific species identified indicates that these remains were likely crucial objects in the ritual process. Additionally, while wood torches were essential tools for conducting rituals in the dark zones of caves, the remains recovered during these investigations were not consistent

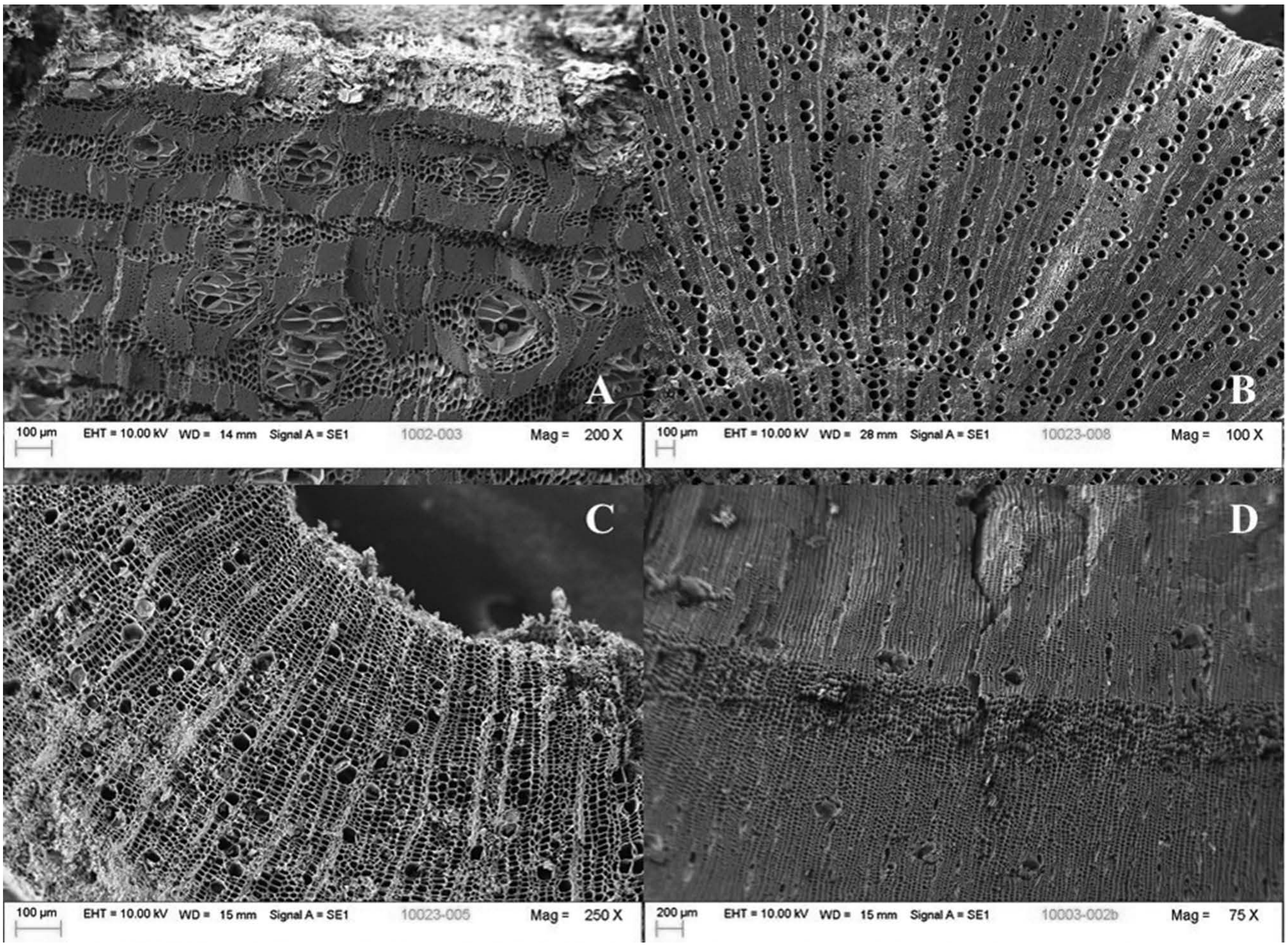
A
B
C
D
100 µm EHT = 10.00 kV WD = 14 mm Signal A = SE1 1002-003 Mag = 200 X
100 µm EHT = 10.00 kV WD = 28 mm Signal A = SE1 10023-008 Mag = 100 X
100 µm EHT = 10.00 kV WD = 15 mm Signal A = SE1 10023-005 Mag = 250 X
200 µm EHT = 10.00 kV WD = 15 mm Signal A = SE1 10003-002b Mag = 75 X

Figure 11.1. Wood charcoal from Pacbitun ritual karst sites: (A) *Piscidia* sp. (note the vessels completely filled with tyloses which suggests heartwood harvested from the centre of the tree), (B) *Bertiera guianensis*, (C) *Alvaradoa amorphoides*, (D) *Pinus* spp.

Table 11.1. Karst sites with identified plant species.

Landmark name	Species
Actun Nohoch Tunich	*Pinus* spp. *Spondias* sp. *Exostema caribaeum*
Actun Xtuyul	*Pinus* spp. *Ficus* sp. *Alvaradoa amorphoides* *Allophylus* sp. *Bertiera guiamensis* *Oxalis* sp.
Actun Merech	*Pinus* spp.
Crystal Palace Cave	*Pinus* spp.
Tzul's Cave	*Pinus* spp.
Slate Cave	*Pinus* sp. *Persea* sp. *Trichilia* sp. *Miconia* sp. *Castilla* sp.
Actun Pech	*Pinus* spp. *Protium* sp. *Xanthoxylum* sp.
Actun Lak	*Pinus* spp. *Protium* sp. *Piscidia* sp.

with the deposition pattern of torch spatter as documented by Moyes (2008). Based on these findings, we suggest that this wood was intentionally burned and deposited as an explicit type of ritual paraphernalia of Classic Maya cave ritual and served an important ritual function. The presence of the wood of several different tree species across cave sites is likely the result of processes of cultural selection.

The burning of ritual offerings was, and still is, a common practice among Maya people (Brown 2004:37; Lucero and Kinkella 2015:179; Morehart 2011; Morehart *et al*. 2005). It is an act that transforms the physical properties of the offering into an intangible spiritual essence that can be consumed by ancestors and deities. Among contemporary K'iche' Maya, the burning of offerings is an integral ritual act that renders material objects into appropriate food substances for the gods (Brown 2004:37). Maya people from Zinacantan, Mexico equate their burning candles as tortillas used to feed the gods (Vogt 1993). Across the Yucatan peninsula, items such as tobacco and incense are used in ritual feasts held for various supernatural entities to invoke them, and ask for their protection and blessing (Gabriel 2007; Gubler 2012). Using such data, Morehart (2011:121) interprets the ritual burning of wood in cave contexts as the release of the spiritual essence of the tree so that it could be transfigured for divine consumption.

Between the eight ritual karst sites investigated, a wide array of tree species were represented, but no single genus, with the exception of pine (*Pinus* spp.), was present at more than two sites. Pine was recovered from all eight of the cave sites sampled. Charcoal from the genus *Ficus* (fig) was present at two sites, Actun Xtuyul and Actun Slate, but could not be identified to the exact species. Many fig species produce edible fruits, and among modern Yucatec Maya communities in Belize the flowers are believed to provide good fortune (Balick and Arvigo 2015:397). The only other species of tree recovered from two sites was *Protium copal*, which was present in Actun Pech and Actun Lak. This species of tree is associated with water and rain (Satterthwaite 1946; Thompson 1970:166). Copal resin is known for its use as an incense, which served ritual functions among the Maya both in the ancient past and the present (Flores and Balam 1997:101). The wood of aromatic trees such as copal and pine were also burned to release their fragrance (Taube 2001).

Six soil samples were taken from Actun Nohoch Tunich, which is part of, and the namesake for, the Nohoch Tunich Bedrock Outcrop Complex (NTC), a hilltop bedrock outcrop rife with smaller karst features that have been subtly, but extensively modified by the Pacbitun Maya (Spenard 2017). In one sample we recovered one of only two remnants of an edible product in the entire sample. This was a pit fragment of a *Spondius* sp., known colloquially as hog plums, which are members of the cashew family (Anacardiaceae). Wood charcoal identified from the site includes pine, Caribbean Princewood (*Exostema caribaeum*) and four other angiosperm dicots of indeterminate species due to their poor preservation. Carbonised resin was also found in one sample as well as a burned plant stem of unknown origin.

Actun Xtuyul is another feature within the NTC. A single soil sample was taken from excavations, but it yielded a wide diversity of botanical products. Present in the sample was the wood of pine, fig, Mexican Alvaradoa (*Alvaradoa amorphoides*), *Allophylus* sp., and *Bertiera guiamensis*. A single carbonised *Oxalis sp.* seed was found and is likely a type of wood sorrel. These herbaceous shrubs are used by the modern Yucatec community in San Antonio, Cayo District for both food and medicine (Javier Mai, personal communication, 2010). Some species of *Allophylus* and *Bertiera* produce edible products as well. Despite evidence of the fruits or pits of these species being absent, the burned wood of edible tree species may have substituted for such food offerings in ritual practices. Two other dicot species were present in Actun Xtuyul but could not be identified to a genus or taxa.

At some of these cave sites, pine was the only species of wood charcoal identified. We collected four soil samples from Actun Merech. One yielded pine charcoal and the other three were sterile. Six soil samples were excavated from Crystal Palace and three of these contained pine charcoal while the other three were sterile. Three soil samples were recovered from Tzul's Cave, but only one contained pine charcoal. All three samples had an indeterminate species of angiosperm dicot, but the charcoal was poorly preserved. Though each of these sites contained pine, quantities of the charcoal were very small (less than half a gram).

With a panel of petroglyphs carved into a bulbous formation at its entrance, Actun Slate is the only karst feature known in the Pacbitun region with parietal art (see chapter ten, this volume). This cave had the greatest diversity of botanical species present compared to the other sites investigated. Identified woods included pine, avocado (*Persea* sp.), fig, three types of legume, a type of wild cherry (*Trichilia* sp.), wild coco plum (*Miconia* sp.), and wood from the Moracea family that is possibly *Castilla* sp., which includes trees that produce a liquid latex used as rubber. Ten other types of angiosperm dicots were present but were poorly preserved and could not be identified. The majority of these woods (with the exceptions of the Moracea specimen and pine) belong to species that produce edible fruits. Their recovery reinforces the theory that the wood of edible tree species may have substituted for the food products themselves. Nevertheless, we exercise caution with the analysis of the findings in this cave because it is well known and visited by the local community for recreational activities, and several modern hearths were noted during the investigations (Spenard and Mirro 2017).

Actun Pech was only one of two caves where copal wood was identified, in addition to pine and possibly prickly ash (*Zanthoxylum* sp.). Today, Maya people from San Antonio village in the Cayo District use prickly ash for a variety of medicinal uses (Javier Mai, personal communication, 2010). Several other angiosperm dicot species were present but were too fragmentary for identifications to be made. Actun Pech contains the remains of six individuals located in a back chamber and placed among offerings of whole and partial vessels (Healy *et al*. 1996; Powis 2010; Weber and Powis 2011). It is one of only a few caves around Pacbitun known to contain human remains, and the Yucatec Maya of San Antonio village regard them as sacred ancestors (Joe Mai, personal communication, 2012).

The site of Actun Lak was the most thoroughly investigated of the karst sites included in this study (see chapter ten, this volume; Spenard 2014). Unlike the other karst features in this study, our excavations recovered an overwhelming amount of paleoethnobotanical data. Near the rear of the cave is a heavily burned chamber that contains a speleothem altar (see chapter ten and Figure 10.4, this volume; Powis *et al*. 2017:205-206; Spenard 2014). Investigations revealed that the matrix around the altar was made up largely of wood charcoal, 98 per cent of which was pine (Parker 2014:159-165). Two partially burned pieces of pine wood were also recovered and provided a radiocarbon date of AD 770-940, placing it within the Late Coc and Tzib phases (Figure 11.2; see chapter ten and Table 1.1, this volume; Spenard 2012:153).

The burning of fresh pine, as implied by the large fragments of uncarbonized wood, produces an abundance of smoke. If fresh pine was being burned in Actun Lak in quantities suggested by the soil matrix of the chamber and the blackened walls, then vast amounts of smoke would have been produced in the process (Spenard 2014). An individual would not have been able to remain in the chamber for long without suffering ill effects or asphyxiating if such a fire was generated.

The extensive architectural constructions and modifications at the entrance of the cave may provide a clue as to the purpose and function of such an event (Spenard 2014). These changes to the cave include restricting the entrance area by elevating the floor up to 6 m, creating a platform just outside its entrance, and placing a series of stairs on the downslope from the platform to a massive cavern at the foot of the hill into which a seasonal creek violently cascaded during times of rain (Spenard 2014). Excavations of the architecture revealed it was constructed during a single event in the Tzib phase (Spenard 2014). The platform may have served as a sort of ceremonial 'stage' where ritual specialists performed rites for an audience positioned outside the cave entrance. It is possible that the smoke produced by the burning of so much pine wood in the chamber at the back of the cave was a critical piece of this ritual spectacle as sufficient quantities were produced that it would have been billowing out of the entrance (Spenard 2014).

The production of smoke from the entrance to Actun Lak would likely have been related to rain ceremonies. Maya people today and in the pre-Hispanic past believed that

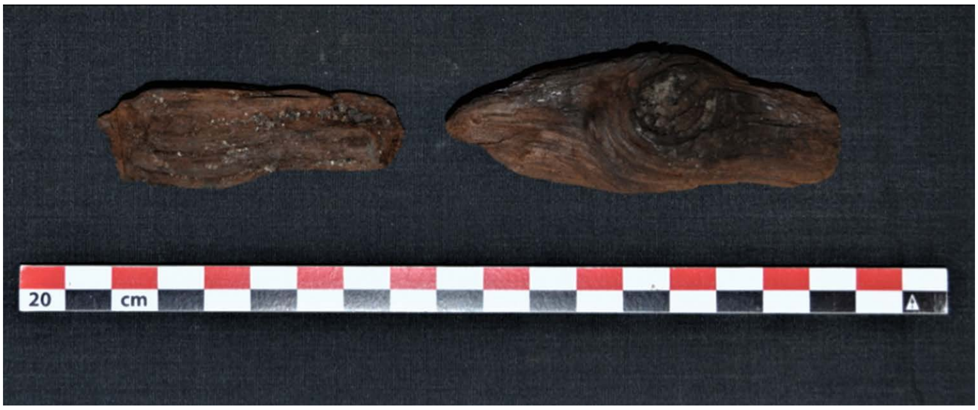

Figure 11.2. Partially burned pine wood fragments from Actun Lak (photograph by Megan Parker).

rainclouds rose out of caves (Gossen 1974:21; Groark 1997:25; Guiteras-Holmes 1961:287; Ishihara 2008:176; Taube 2001). Such clouds could be produced through the burning of pine or copal (Cline 1944:113; Lucero and Kinkella 2015:179; Satterthwaite 1946:17; Taube 2001; Thompson 1970:166). Actun Lak was one of the two cave sites where copal wood was identified. In addition to pine and copal, however, *habin* (*Piscidia* sp.) wood charcoal was also identified and was only found at this site. This species has symbolic associations to rain and water and is a component of modern Yucatec Maya ch'a chaak altars used in rain ceremonies (Flores and Balam 1997:105; Gubler 2012; Morehart 2011:114). The presence of all three of these woods and the possibility that pine was burned to produce symbolic rainclouds is consistent with interpretations that Actun Lak served as a community rain shrine (see chapter ten, this volume; Spenard 2014).

The quantity of pine found in Actun Lak is astounding when compared to samples from the other cave sites investigated. On average, a 1-litre soil sample from the other seven karst sites produced anywhere from one half to four grams of total wood charcoal, with small amounts representing pine. Alternatively, from a single 1-litre sample in Actun Lak we recovered 49 grams of exclusively pine charcoal. Based on interpretations of pine as an elite-controlled resource, in combination with the recovery of artefacts such as jadeite, polychrome ceramics, and obsidian, it seems plausible that Actun Lak served a special function in Pacbitun's karstscape. This is not to suggest that the cave was under the exclusive control of the elite. Rather, as Spenard (see chapter ten, this volume; 2014) has detailed elsewhere, ceramic data suggest it long served as a community rain shrine for all members of Pacbitun, yet, when a series of multidecadal droughts further undermined the weakening office of the *ajaw*, in the 9th century, the royal lineage appropriated the space, transforming it into a stage for public performance.

Supporting Case Studies and Interpretations

Wood used in cave rituals may also have been chosen based on their symbolic attributes. Ethnoarchaeological studies of Kaqchikel Maya cave ritual may provide some insight into the purpose of the wood in Pacbitun's caves (Scott 2009). Candles are an essential ritual object in contemporary Maya cave rituals (Scott 2009:28). The Kaqchikel use at least ten different colours and each have distinct symbolic meaning. Some contemporary Maya groups describe pine as being analogous to candles used in ceremonies (Oakes 1951; Redfield and Villa Rojas 1934; Tedlock 1992; Vogt 1993). Among the Tzotzil, black candles are specifically associated with pine wood as well as darkness, night, death, and sacred corn—all qualities linked with caves (Vogt 1993; see also Scott 2009:43). The K'iche Maya consider candles to be tortillas or other food offerings for the gods (Brown 2004:36). It may be that modern candles substitute for the use of wood in the ancient past and that certain trees have corresponding symbolic attributes with the different coloured candles in modern Maya rituals. Since the colour of the candle used depends on the practitioner's particular needs, it seems plausible that wood charcoal recovered from Pacbitun's caves had similar functions and reflect the various needs and goals of members throughout the community.

Archaeological investigations lend support to the theory that the burning of wood was a common element in ancient Maya ritual practice. Morehart's (2011; Morehart *et al*. 2005) paleoethnobotanical cave studies in the Belize River Valley also noted the extensive use of symbolically significant wood in ritual offerings. Dussol and colleagues (2016) examined the role of firewood in Maya burials from the site of Rio Bec in Campeche, Mexico and documented the intentional use of certain species of wood during the Terminal Classic period. By comparing the charcoal assemblages of burials, non-funerary ritual events, and domestic hearths the authors were able to conclude that ritual contexts exhibited different patterns of wood use than that found by random firewood selection (Dussol *et al*. 2016).

Pine is commonly recovered from archaeological sites across the Maya lowlands (e.g., Chase and Chase 1998; Lentz 1991, 1999; Lentz *et al*. 1996, 1997; Morehart 2011; Wyatt 2008). However, it is a geographically restricted species that is present only in some parts of highland Guatemala and certain areas of Belize such as the Mountain Pine Ridge. The ubiquity of the wood coupled with its geographic restrictions suggests a well-established system of exchange in the past. Pine may have been preferred in ritual performance because of its fragrance and high resin content, though it also served daily functions. Ocote, bundles of thin pine sapwood, served as torches. The *taj* glyph, which is related to maize symbolism, is depicted as a bundle of burning pine torches, which has led Morehart (2011:108-109) to propose that pine wood was a symbolic food offering to the gods. The distribution of pine across archaeological sites and contexts suggests that it was a prestige good linked to elite control (Lentz *et al*. 2005; Morehart *et al*. 2005). Lentz and Hockaday's (2009) paleoethnobotanical studies at Tikal indicate that elites managed stands of primary forests into the Late Classic period. The fact that most pine charcoal recovered from the Pacbitun karstscape was from mature trees (in contrast to the hardwoods) further supports the proposition that pine forests were under elite control. Pine nonetheless appears to have been required in order to perform successful rituals.

Trees had many symbolic associations and were significant to the ancient Maya. The most recognisable aspect of this tree symbolism comes from the Maya world tree, which is often associated with the kapok or ceiba tree (Knowlton and Vail 2010; but see McDonald 2016 for alternative identifications). The world tree is generally depicted as growing forth from a watery underworld and ascending into the sky (McDonald 2016:222; Miller and Taube 1993:177). As such, it acts as both a prop and a portal that holds the various levels of the Maya world together, an access point between the earth and its celestial and underworld realms (Christie 2005:277; Friedel *et al*. 1993:138-152; Klein *et al*. 2001:390; Knowlton and Vail 2010:712; McDonald 2016). It was the path that the deceased travelled along to reach their next destination and this symbolic plant was a means of communicating across these realms with the aid of sacred ancestor deities (Bassie-Sweet 2008:72; Knowlton and Vail 2010:712; Miller and Taube 1993:186).

The world tree stands at the heart of the earth acting as the axis mundi that marks the place of creation. Certain mountains and caves are also associated with creation and referred to as the axis mundi (Brady 2003:89; Lucero and Kinkella 2015:166; Thompson 1970:348-354). Cave formations are sometimes regarded as ceiba trees (MacLeod and Puleston 1978:74). An iconographic example comes from the site of Ek Balam in northern Yucatan, Mexico. At the site, a Classic period jaguar jaw doorway depicts the world tree on the left and right panels. One panel shows the roots extending into the underworld to shield immature ears of maize growing there (Figure 11.3). Immature maize was used during first fruit rites and have been found in caves associated with fertility rituals (Boremanse 1993:334; Morehart 2011:115; Redfield and Villa Rojas 1934:127). The association of the world tree image at Ek Balam with immature maize reinforces this connection between trees, sacred corn, and the underworld.

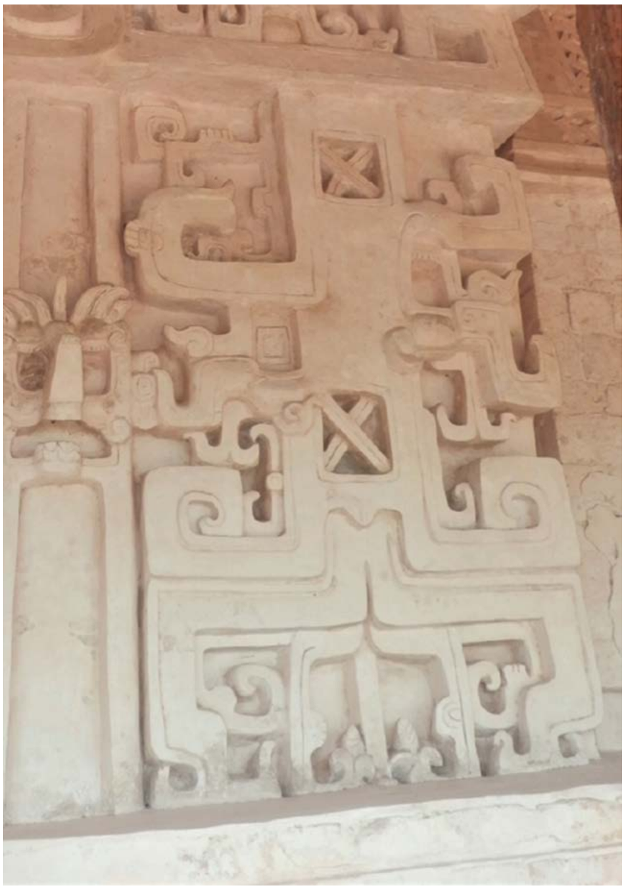

Figure 11.3. Panel of Ek Balam Classic period doorway showing world tree and immature maize growing in the underworld among its roots (photography by Megan Parker).

Indeed, charred maize was the most common domesticated crop recovered from paleoethnobotanical investigations of caves in the Belize Valley (Morehart 2011:100). Maya cosmology tells us that maize was brought to the people from the depths of the underworld (Saturno *et al*. 2005; Thompson 1970:348-354). The Maize God is often depicted as a tree emerging from a portal in the earth (Taube 1985:175) or as the world tree itself (Taube 2003a:461). The kan cross, a symbol that represents the world tree and the four corners of the universe, is one of the earliest known motifs found on ceramic serving vessels in the Belize River Valley (Brown *et al*. 2018:98). With this symbol 'vessels… are symbolically transformed into portals' (Brown *et al*. 2018:98). Each quadrant of the Maya world is associated with a specific tree and colour (Christie 2005:277; Knowlton and Vail 2010:711; Taube 1988:214).

Christie (2005) interprets Maya stelae as manifestations of sacred trees based on Schele and Stuart's (1985) proposal that the word *te' tun* means 'stone-tree' (but see Stuart 1996 for alternative translation). The Dresden Codex supports the association between stelae and trees, depicting such objects as dressed in clothing (Christie 2005:282-283). These stelae were carved with images of ancestors and fed incense to bind them to the stone. Ritual acts in caves associated with the burning of specific woods and resins may reflect efforts to communicate with ancestors by temporarily binding them to the earthly realm (Astor-Aguilera 2009, 2010). This possibility is supported by the fact that ancestors are sometimes depicted as anthropomorphized fruit trees such as on the sides of Pakal's sarcophagus from Palenque, Mexico (Dussol *et al*. 2016:69; Filloy 2014:258-259; Ruz 1973). Holland (1964:303) recorded that Tzotzil Maya people directly associate sacred mountains with mythological ancestors. These studies suggest that ancestors were active ritual participants who assumed the function of the world tree as portals to the divine and embodiments of the capacity to communicate between worlds (Christie 2005:281; Lucero and Kinkella 2015:165).

Contemporary Maya people of highland Chiapas often use small trees or branches as substitutes for crosses in shrines or altars (Christie 2005:283; Newsome 2001:212-213; Vogt 1969:388). This is particularly interesting considering that most of the angiosperm dicot woods recovered from karst sites at Pacbitun were from small trees or branches. At least three such trees are required in contemporary shrines even when crosses are present, and these are dressed in clothing or flowers (Christie 2005:283-284). These objects are said to represent ancestors 'dressed and waiting for candles for their food' (Christie 2005:284; Vogt 1993:49). Maya people from Zinacantan use wooden crosses to designate the edges of sacred space, water, caves, or the mountains where gods reside (Vogt 1993:44). They are described as doorways or portals that enable individuals to communicate with ancestors (Christie 2005:283). These markers may indicate a continuity in the use of wood to communicate across realms or to sanctify sacred space. The use of trees in place of crosses indicates 'that the crosses themselves are understood as a type of tree' and the use of trees in consecrating space is likely Pre-Columbian in origin (Christie 2005:284). Based on these studies, it seems plausible that the presence of diverse tree species across sites may indicate activities related to communication with divine ancestors among the Pacbitun Maya.

McAnany (1995) examines ancestor worship among the ancient Maya and traces these ritual practices from the Late Preclassic and into the Colonial period, indicating significant cultural continuity regarding ancestor cults. Brown and colleagues (2018:124) document the evolution of ancestor veneration in the Belize Valley and demonstrate that emerging elites in the Late Preclassic began to manipulate these traditional practices to elevate the status of their own lineages. Doing so enabled them to legitimise social hierarchies and maintain their own authority. Locally, this is perhaps seen at Pacbitun in the changes to Plaza A, specifically the transformation of the E Group into an Eastern Triadic Assemblage (see chapter five, this volume). Other such strategies nacent elites may have utilised to do this was restricting access to certain tree species such as pine and depicting rulers associated with the world tree in art (Klein *et al*. 2001:397). Such an association centres the royal lineage as the axis mundi within the community and positions them as portals of communication between people and the supernatural. This act may have legitimised claims to power that enabled elites to appropriate community shrines, such as Actun Lak, to perform rites that reinforced state-sanctioned ideologies.

Conclusions

These paleoethnobotanical cave investigations lead us to believe that ritual karst assemblages document the ways in which all members of the Pacbitun community engaged with their sacred landscape. They did so by contacting sacred ancestors and establishing pathways of communication with the divine through the burning of particular species of wood. There is no consistency between the types of trees used in cave rituals, with the exception of pine. This indicates the use of cave spaces by diverse social actors throughout the community who engaged in ritual practice to suit their needs and concerns. In addition to wood being a means of communicating with ancestors, it also likely had important symbolic associations. *Habin* and copal wood, for example, had links with water and fertility. The presence of pine at all cave sites supports theories that it was a necessary religious offering incorporated into the ritual economy as a prestige good under the control of elites. Even at Pacbitun, a site located in close proximity to pine forests, there is a clear restriction in access to this wood at ritual karst sites, though paleoethnobotanical work at surface sites could refute or confirm whether this is true in secular contexts.

By taking a social paleoethnobotanical approach to the archaeological record, we have demonstrated that ritually burned wood had crucial religious functions among the ancient Maya. The ethnographic record describes such objects as not simply trees or fuel for ritual burning. Wood was burned to transform what was tangible into a divine spiritual essence. Trees became physical manifestations of powerful ancestors, or the food used to summon them. These examples suggest a fundamental link existed between trees, rituals associated with them, and ancestral beings. Both caves, and the wood burned within them, became portals to interact with the supernatural. It seems likely that the diversity of wood charcoal recovered throughout Pacbitun's karstscape indicates rituals associated with ancestor worship. Royal families may have used these domestic practices and incorporated them into state-level ideologies by reifying their own lineages. However, such ritual practices were crucial for all social actors regardless of socioeconomic status, and these archaeological data reflect the behaviours and practices of everyone in the Pacbitun community.

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12

Exploring Maya Ritual through Absorbed Residues in the Belize Valley

Adam King, Terry G. Powis, Jon Spenard, and Nilesh Gaikwad

In this chapter, we discuss the preliminary results of a research line that has never been attempted before—absorbed residue analysis of pottery vessels and bone tubes collected from cave sites. Caves hold a special place in the belief system of the ancient and modern Maya. They are the place of creation, the source of life-giving water, and animate earth forces. As such, caves in the Pacbitun area served as the location for a variety of rituals from the Late Preclassic through the Terminal Classic period (see chapters ten and thirteen, this volume; Spenard 2014). Our results, while preliminary, shed light on caves and their ritual uses.

Analytical Methods

Our results are based on targeted mass spectrometry analyses of physical samples of pottery vessels and bone tubes. The targeted method of analyses attempts only to detect specific biomarkers that are indicative of specific concoctions or ingredients (Figure 12.1). As such, targeted analysis can only tell you whether the things you are looking for are in the samples analysed. For this study we selected biomarkers that we had previously detected in other absorbed residue studies. That means we had the standards, knew what the spectra should look like, and had already demonstrated we can see them in archaeological samples (King *et al*. 2018).

Untargeted analyses are designed to detect all elements and compounds in a sample. These take longer to run and are more complex to interpret. We have submitted these same samples for untargeted analysis and await the results. When available, they will give us a much fuller picture of what was once in each the vessels and bone tubes recovered from caves in the Pacbitun area. Until those data are available, our preliminary results show some interesting patterns.

The Sample

For this study, we sampled 10 pottery vessels and six bone tubes made from deer long bones recovered from four cave sites in the periphery of Pacbitun (Table 12.1). Vessels were not chosen based on any particular decorative element or slip colour, but instead were selected to represent the variety of forms and types found in each cave. Bone tubes were chosen based on their degree of preservation. Those tubes that could not withstand the sampling process were eliminated from consideration. The pottery samples were collected from vessels found in three caves: Actun Lak, Actun Hayach Naj, and Tzul's Cave. In Actun Lak (see Figure 10.2, this volume) two dishes were sampled. Both were part of Feature 1, which was an Early Classic, Tzul phase (see Table 1.1, this volume) offering located in the main chamber, Chamber 1, of the cave. The pots, identified as Hewlett Bank Unslipped vessels (Gifford 1976:190), were vertically stacked and touching, but horizontally staggered. At Actun Hayach Naj Cave, we sampled an Early Classic Aguila Orange (Gifford 1976:180) tripod plate that was found in an artificially enclosed alcove beneath the cave floor in Chamber 1. At Tzul's Cave (see Figure 10.10, this volume), seven of the pottery vessels were sampled. These were found clustered together in Chamber 1—the largest observed offering found in the cave. Each of the vessels dates to the Terminal Classic, Tzib phase (see Table 1.1, this volume), with three of the pots identified as Mount Maloney Black ollas (Gifford 1976:243-244).

All seven of the bone tubes sampled were found in the Late Classic, Coc phase (see Table 1.1, this volume) Feature 1 in Slate Cave (see Figure 10.12, this volume; Spenard and Mirro 2017). This feature was excavated into the cave floor and lined and capped with stones. There is some evidence that it was disturbed after being deposited. Whether this was done by the ancient Maya or modern looters is unknown. Within the feature was found a human skull, mandible, and scapula, along with a chert flake and bone tubes. Because of the disturbance, it is not clear if this represents the interment of a person or some other kind of offering, or possibly both (see chapter ten, this volume).

Caves, Pots, and Bone Tubes

The context of the vessels and bone tubes is a critical part of interpreting our residue results. In Mesoamerica, caves are associated with water and also thought of as the place of creation. Mountains and caves were conceptually related in pre-Hispanic Mesoamerican thought (Brady and Ashmore 1999). Mountains were thought of as animate water receptacles, and their breath, symbolised by snakes exhaled from their cave maws, carried the liquid out of the underworld and into the sky, creating clouds of rain (Broda 1991:84; Taube 2001:104). Several related myths from the Aztec and contemporary Central Mexican communities tell of gods who collect and store jars of water in their caves, which they then pour out as rain over the land

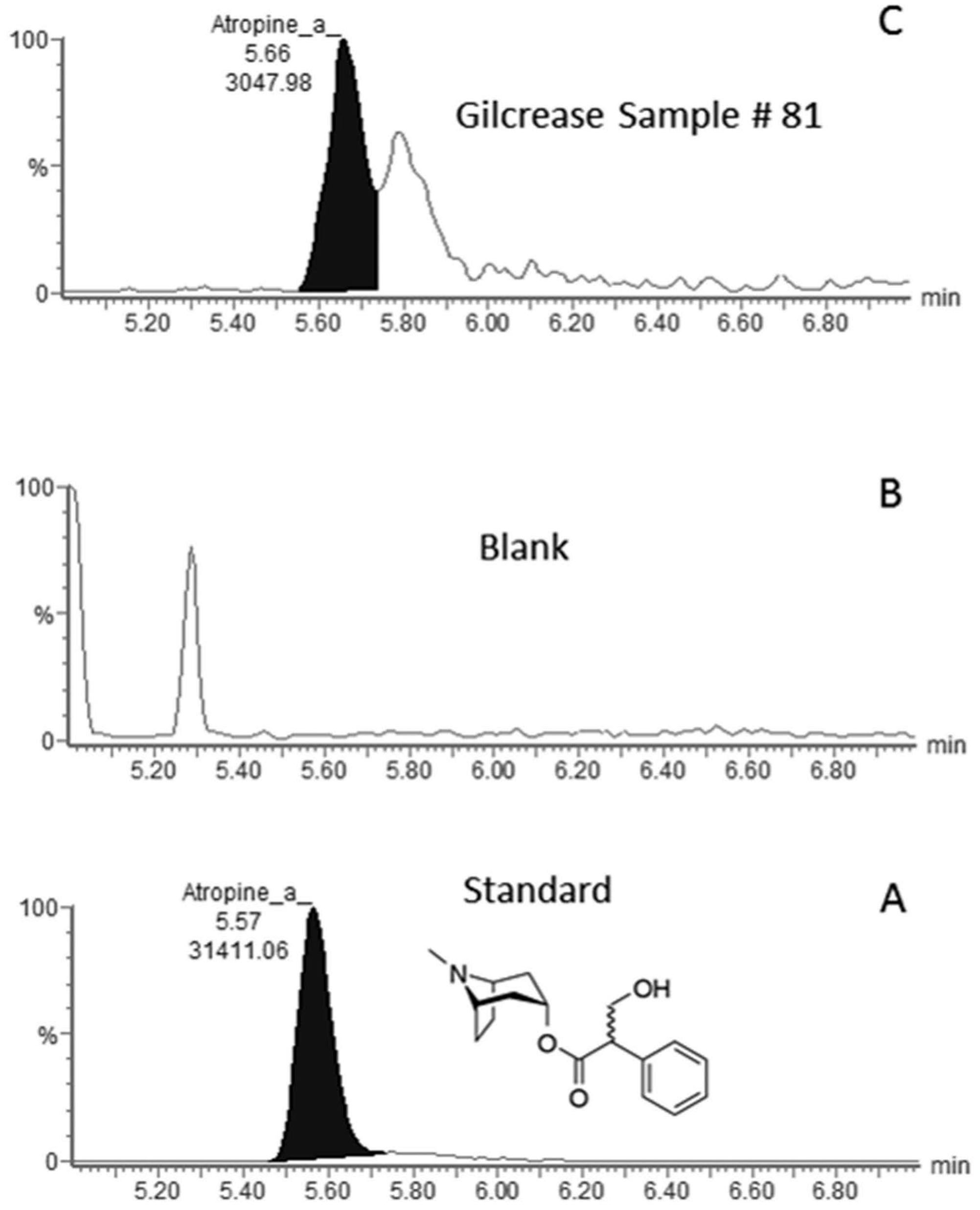

Figure 12.1. Spectrograph of Blank, Standard, and Archaeological Sample produced by Mass Spectrometry.

(Rands 1955:344). In the Titles of Tetzcotzingo, the king, Nezahualcoatl, mentions that the hills surrounding the Valley of Mexico are filled with water (McAfee and Barlow 1946). Furthermore, the Aztec called mountains, atoyatl, ‘running water,’ referring to the rivers flowing from them (Townsend 1992:181). They also believed that mountains could dissolve if necessary, releasing enough water to flood the world (Sahagún 1963:247).

Based on these details, it is reasonable to expect that many of the rituals conducted in caves centred thematically on water and rain—two things important to agriculturalists. In each of the caves from which samples were drawn, their interiors have been altered to create niches, altars, and other ritual spaces (see chapter ten, this volume). Associated with these different spaces are assemblages of pottery vessels that presumably were used in rituals or held offerings as part of rituals.

As amplification of this, carrying and lifting water-filled jugs, a metaphor for rain, was common to ancient Mesoamerica thought (Schaafsma 1999). For example, Late Classic period Quirigua Zoomorph P depicts flying Chahks pouring water from jars (Schaafsma and Taube 2006:249). Late Preclassic period Izapa Stela 1 depicts the god with a jar strapped to his back from which flow torrents of water, producing a stream that he fishes (Norman 1973). Thus, jars deposited in caves, likely indicate rain rituals performed inside of mountains.

Caves also played a key role in creation as related in the Maya creation story. Zoomorphic mountains often have flowers and other foliage growing out of them, and wild animals cavorting on their outer surfaces, representing Flower Mountain, the mythological place of paradise, ancestors, abundance, life, and fertility (Taube 2004). The most explicit representation of these qualities of that

Table 12.1. Residue samples analysed from caves sites in the periphery of Pacbitun.

Sample	Material	Cave	Context	Object
1	Bone	Slate	Feature 1	Tube 8
2	Bone	Slate	Feature 1	Tube 13
3	Bone	Slate	Feature 1	Tube 4
4	Bone	Slate	Feature 1	Tube 12
5	Bone	Slate	Feature 1	Tube 3
6	Bone	Slate	Feature 1	Tube 2
7	Soil	Slate	Bone Tube 2, Feature 1	Soil near Tube 2
10	Paper			JD Copy-Rite copier paper
13	Ceramic	Actun Lak	Chamber 1, Unit 8/9, Level 2, Feature 1	Vessel 1 Hewlett Bank Unslipped bowl
14	Ceramic	Actun Lak	Chamber 1, Unit 8/9, Level 2, Feature 1	Vessel 2 Hewlett Bank Unslipped bowl
15	Ceramic	Actun Hayach Naj	Chamber 1, Surface	Aguila Orange tripod plate
18	Ceramic	Tzul's		Small black slipped jar
19	Soil	Tzul's	Chamber 1, Group 1	Under large Mt. Maloney olla sherd
20	Water			RYO Demineralized Water
21	Ceramic	Tzul's	Chamber 1, Group 1	Red slipped dish with legs snapped off
22	Ceramic	Tzul's	Chamber 1, Group 1	Large Mt. Maloney olla with narrow orifice
23	Ceramic	Tzul's	Chamber 1, Group 1	Large Mt. Maloney olla with narrow orifice
24	Ceramic	Tzul's	Chamber 1, Group 1	Large red slipped dish with ring base
25	Ceramic	Tzul's	Chamber 1, Group 1	Small red slipped bowl with psuedoglyphs
26	Ceramic	Tzul's	Chamber 1, Group 1	Black slipped bowl with rolled rim
27	Water			RYO Demineralized Water

mythical place is the North Wall mural from San Bartolo, Guatemala (Saturno *et al*. 2005). The mural shows a zoomorphic Flower Mountain dominated by a gaping, stalactite-fanged cave maw, out of which a large, feathered breath snake emerges. The exhaled serpent running along the base of the scene eventually turns upwards and emits its own moist breath as 'S'-shaped scrolls similar to those that Taube (2001:107) argues are rain clouds. Although eight individuals engaged in various activities stand on the back of a serpent, the scene pivots on an individual with Olmecoid maize god features. He grasps a water gourd while looking over his shoulder at a kneeling woman who appears ready to receive the object, with another kneeling woman in the maw of the cave holding a basket of tamales. Together, the water and tamales from the cave indicate the fecundity of Flower Mountain, and the entirety of the scene bracketed by the Flower Mountain Cave and its upturned Feathered Serpent breath shows an early Maya version of the emergence myth. Given this, it is possible that some activities conducted in caves had to do with creation (see chapters ten and eleven, this volume).

The bone tubes sampled were found associated with human skeletal material in Slate Cave (see chapter ten, this volume; Spenard and Mirro 2017). While it seems likely that the placement of the remains and associated materials had something to do with the symbolic meaning of caves, it is not clear that the bone tubes themselves were used in cave rituals. Instead they may have been used outside of the cave and brought in with the deceased.

It has long been argued that bone tubes were part of enema clyster syringes, which were used to administer alcoholic or mind-altering substances in ritual contexts (Coe 1993:180-181). The beverage most likely used in these rituals was balche' (Furst and Coe 1977), an alcoholic drink made from honey and the bark of the balche' tree *(Lonchocarpus violaceus*). Ethnographic and historical sources suggest that a variety of different ingredients were added to the balche' consumed in ceremonies, including cacao, entheogens deriving from mushrooms, toads or *Datura,* and flavourings like vanilla, chili and plumeria flowers (Ratsch 2005). If the bone tubes found in Slate Cave were used to deliver enemas, we might expect to find residues containing alcoholic beverages and possibly entheogens on them.

Datura, Cacao, Vanilla, Chili, and Salicylic Acid

In this preliminary study, we focused on detecting biomarkers that we had been able to detect in other archaeological examples (King *et al*. 2018). Clearly, given the variety of substances that may have been used in cave offerings and ritual enemas, our test substances are quite limited. Still, each of the substances we detected has some connection to the ancient Maya and may tell us something about activities conducted in caves.

Datura is a genus of flowering plants in the Solanaceae family whose leaves, seeds, and flowers contain tropane alkaloids like atropine, scopolamine, and hyoscamine (Lester *et al.* 1991). These alkaloids produce mind-altering effects and can be toxic when consumed in high enough doses. Ethnographic evidence suggests that the ancient Maya may have added *Datura* to fermented drinks as a means to induce visions (Stross and Kerr 1990:355). Schultes (1972:47) discusses the Tarahumara's addition of *Datura* to a fermented maize drink, and the use of the roots, leaves, and seeds of the plant to make a vision-inducing beverage that medicine men use to diagnose disease. Litzinger (1994:134) furthers the argument that *Datura* may have been used by the ancient Maya by noting that the plant is associated with death, war, directional symbolism, and transformation among the Yucatec and Lacandon Maya of today. He argues that these attributes are at the core of ancient Maya religious thought and thus may have had a ceremonial significance. Given this, we considered it reasonable that *Datura* may have been an ingredient in cave ritual and enemas.

It has long been known that cacao was intimately associated with the nobility in Classic Maya society and was even used as a form of currency in the Late Classic and Colonial periods (Coe and Coe 2007; Dreiss and Greenhill 2008). Elite polychrome drinking vessels regularly included text labeling them as personal chocolate drinking cups (Colas *et al.* 2002; Houston and Taube 1987; LeCount 2001). However, recent research shows that cacao was available to most people in the Pre-Hispanic Maya area where it was used in rituals and lineage feasts (LeCount 2001; McNeil 2006:18). This was especially the case in areas where cacao was grown, like the western Belize Valley (McAnany and Murata 2006:446; McNeil 2006:18).

Two of the plants of interest were domesticated in Mexico and recorded as being used as flavouring for cacao and other beverages in historical and ethnographic descriptions. One of these, vanilla, is a flavouring made from the dried fruits of orchids in the genus Vanilla, while the second, is chili (*Capsicum annuum*) (Kraft *et al*. 2014; Rain and Lubinsky 2011).

Salicylic acid is found in the bark and leaves of willow trees and has long been known to possess analgesic, antibacterial, and anti-inflammatory properties (Norn *et al.* 2009). Several different species of willow are found in Central America, all of which generally prefer damp habitats or areas near water (Newsholme 1992). Reinforcing this connection to water, Breedlove and Laughlin (1993) recorded that the Tzotzil-speaking Maya of the Highlands of Chiapas consider willows to be the origins of water and plant willow trees near water holes to ensure that they do not dry up. Given this association with water, it is possible that willow featured prominently in cave rituals. The absence of willow in the wood samples analyzed from the caves (see chapter eleven, this volume) suggests that leaves or bark were part of these rituals but wood from willow trees was not.

Impacts of Contamination

In conducting absorbed residue studies, modern contamination of the objects or samples is always a concern (see King *et al.* 2017; Washburn *et al.* 2014). The greatest risk of contamination comes as objects are removed from the archaeological record, processed, analysed, stored, and sampled for residues. While direct contact with contaminants is always possible, more likely is contamination through contact with dust or water. A wide variety of chemicals and compounds are ubiquitous both in the air and in our water systems. For our current study, we assumed that the risk of contamination from these sources is very low. With the exception of the vessels sampled from Actun Lak, all samples were collected directly in the caves. The vessels from Actun Lak were removed from the cave, cleaned, classified and stored in closed containers. The bone tubes were recovered in Slate Cave, received minimal cleaning, and were stored in closed containers until sampling. Our assumption was confirmed when we analysed samples of soil from two caves (Table 12.1) and detected none of the biomarkers of interest.

For our samples, the greatest risk of contamination came from the people collecting the samples and the methods used to collect them. We attempted to reduce that risk in the following way. A mask was worn during sampling and each sample was collected with a clean pair of gloves using a metal Dremel bit cleaned with demineralized water. Samples were collected on a clean piece of paper before being transferred into an unused vial cleaned with demineralized water.

To assess the possibility that our sampling materials contaminated our results, we analyzed the demineralized water and a sheet of the paper used to collect the samples (Table 12.2). One of the water samples analysed contained none of our biomarkers, but a second sample contained trace amounts of salicylic acid. The sample collected from a sheet of the collection contained small amounts of caffeine and vanillic acid. Based on these results, we considered any other positive samples potentially contaminated if they contained amounts of salicylic acid, caffeine, or vanillic acid below those found in the paper and water.

Results

Half of the samples analysed (8 out of 16) tested positive for at least one of the biomarkers of interest (Tables 12.2 and 12.3). The most frequently detected biomarker was salicylic acid, which was present in three-quarters of the positive samples. Salicylic acid is a common constituent in airborne and waterborne contamination. However, given the protected nature of the caves, it seems unlikely that its presence is the result of modern activities. This opens the possibility that willow, because of its close association with water, may have been an important element in the water-related ceremonies that took place in caves.

Table 12.2. Residue sample results of mass spectrometry.

Sample	Material	Cave	Dihydro-capsaicin	Capsaicin	Atropine	Vanillin	Vanillic Acid	Salicylic Acid	Theobro-mine	Theoph-ylline	Caffeine
			ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g
1	Bone	Slate	0	0	0	0	12.5	0	0	0	0
2	Bone	Slate	0	0	0	0	0	0	0	0	0
3	Bone	Slate	0	0	0	0	0	0	0	0	0
4	Bone	Slate	0	0	0	0	0	0	0	0	0
5	Bone	Slate	0	0	0	0	0	19.6	0	0	0
6	Bone	Slate	0	0	0	0	0	23.5	0	0	0
7	Soil	Slate	0	0	0	0	0	0	0	0	0
10	Paper		0	0	0	0	33.5	0	0	0	76.1
13	Ceramic	Actun Lak	0	0	0	0	0	1407.6	0	0	0.739
14	Ceramic	Actun Lak	0	0	0	0	0	458.9	0	0	0
15	Ceramic	Actun Hayach Naj	0	0	0.016	0	0	876.5	2.69	0.25	2.48
18	Ceramic	Tzul's	0	0	0.024	0	0	0	0	0	0
19	Soil	Tzul's	0	0	0	0	0	0	0	0	0
20	Water*		0	0	0	0	0	0	0	0	0
21	Ceramic	Tzul's	0	0	0	0	0	0	0	0	0
22	Ceramic	Tzul's	0	0	0	0	0	0	0	0	43.3
23	Ceramic	Tzul's	0	0	0	405.5	0	0	0	0	20.5
24	Ceramic	Tzul's	0	0	0	0	0	0	0	0	19.6
25	Ceramic	Tzul's	0	0	0	0	0	0	0	0	0
26	Ceramic	Tzul's	0	0	0	0	0	62.8	0	0	0
27	Water*		0	0	0	0	0	1.16	0	0	0
*ng/l											

Two samples were found to contain *Datura* and one had residues indicative of vanilla. Because *Datura* is well known as a hallucinogen that was used in Maya shamanistic rituals, it is not surprising to find that it was used in cave rituals. The presence of vanilla is a little more surprising, but it has a connection that may prove to be significant. In current Maya practice (Ratsch 2005), vanilla is an ingredient added to the fermented drink used in a variety of ceremonies, including shamanistic rituals. We may be on thin ice, but it may be that the presence of vanilla is an indicator of the presence of those fermented drinks, possibly balche'. It is worth considering the fact that the sample containing evidence for vanilla came from a large jar that would have held concoctions to be consumed in cave rituals. This potential connection between vanilla and balche' is one worth exploring through future cave residue studies.

Cacao also was found in only one sample. Cacao was closely associated with the nobility in ancient Maya society (Coe and Coe 2007), therefore its presence in one vessel may make some connection to nobles and their practices. It is interesting that cacao is found in the only vessel that was positive for more than one biomarker. That vessel is a tripod plate found in Actun Hayach Naj Cave and in addition to cacao, it also had residues from *Datura* and salicylic acid in it. This plate is a good candidate for an offering vessel and its contents were associated with nobility, shamanism, and water.

No residues were found containing the biomarkers for chili. Historical information documents the addition to chili to elite beverages like cacao and also to ritual beverages like balche'. Its absence from our sample may indicate that it was not part of ritual practice in caves. Its absence may also be the result of sampling error.

Discussion

The context of the samples also reveals some interesting patterns. Seven of our samples were taken from bone tubes that have been argued to be part of the syringe used to deliver ritual enemas. Given this, their residues could reveal at least some of the ingredients of the concoctions involved. Unfortunately, a residue was detected on only one the bone tubes and the biomarker present is salicylic acid. There is no historical information or imagery indicating that willow was added to ritual enemas, so its presence on

Table 12.3. Residue samples positive for plants of interest.

Sample	Material	Cave	*Datura*	Vanilla	Willow	Cacao
1	Bone	Slate				
2	Bone	Slate				
3	Bone	Slate				
4	Bone	Slate				
5	Bone	Slate			**X**	
6	Bone	Slate			**X**	
7	Soil	Slate				
13	Ceramic	Actun Lak			**X**	
14	Ceramic	Actun Lak			**X**	
15	Ceramic	Actun Hayach Naj	**X**		**X**	**X**
18	Ceramic	Tzul's	**X**			
19	Soil	Tzul's				
21	Ceramic	Tzul's				
22	Ceramic	Tzul's				
23	Ceramic	Tzul's		**X**		
24	Ceramic	Tzul's				
25	Ceramic	Tzul's				
26	Ceramic	Tzul's			**X**	

the bone tubes adds an entirely new potential ingredient to those enemas. Given the association between willow and water, it may be an ingredient added specifically for cave rituals.

The two vessels sampled from Chamber 1 of Actun Lak were found buried together in a cache. The bowls were stacked right side up on top of one another but offset horizontally. The middle of the base of the upper bowl was placed on the outer rim of the lower. These appear to have been containers that held an offering left behind in the cave. Both vessels tested positive only for salicylic acid, which again may have had an important symbolic connection to water rituals.

In Actun Hayach Naj Cave, a single tripod plate was found in an enclosed alcove beneath the floor. This is another candidate for an offering vessel whose contents may tell us about the nature of offerings left in caves. The vessel contained the biomarkers for *Datura*, salicylic acid, and cacao and is the only one sampled that contained multiple biomarkers. As already discussed, *Datura* is well known as an entheogen that was used in Maya shamanistic rituals, willow may have an association with water rituals, and cacao featured prominently in the practices of the nobility as well as other kinds of ritual. This could confirm three important assumptions about cave rituals: that some were conducted by nobility, that they were conducted in mind-altered states, and that they may have been associated thematically with water.

At Tzul's Cave, seven pottery vessels were sampled. These were all part of a single, large deposit found in Chamber 1. It is possible that this assemblage includes both jars and bowls used in rituals in the cave, as well as an offering left behind. One of the jars tested positive for *Datura* and another contained the biomarker for vanilla. Both vessels may have held beverages consumed during ceremonies in the cave. A third vessel—a small bowl found atop one of the jars—tested positive for salicylic acid. This may have been used to hold concoctions used in the cave, but then was left as a cover over an offering in a jar.

Conclusions

Admittedly this is a preliminary study that is limited in scope. Our sample of vessels and bone tubes is not large, and we have only attempted to detect a relatively small number of different biomarkers. Still, our results provide some new and interesting insights into ritual activities conducted in caves around Pacbitun.

One of the most robust, and most interesting, of these insights is the apparent importance of willow in cave rituals. The only natural source of salicylic acid in Belize is the several species of willow trees present. Given the fact that salicylic acid was the most common biomarker detected, we interpret this as strong evidence that some part of the willow tree was integral to the conduct of ceremonies in caves. As noted already, this is likely because of the close association of willow with water, both physically and in the beliefs of modern Maya speakers.

Although not nearly as abundant, our detection of *Datura* is significant. It is generally assumed that the ancient Maya used *Datura* as one source of hallucinogens. This idea is supported by ancient imagery and historic texts, but until now *Datura* use has not been demonstrated directly. *Datura* is not easy to find in the archaeological record because it was generally consumed. Absorbed residues present a reliable way to find *Datura* use in past behaviours.

Our detection of vanilla is also something new and interesting. Like *Datura*, it has been assumed that vanilla was added to ancient Maya beverages, ritual and non-ritual, but never demonstrated. We may find that vanilla is a useful proxy for fermented beverages used in ritual contexts.

The results from the bone tubes was disappointing, as only one was positive for our biomarkers. This may mean that residues do not preserve well in bone left in the archaeological record. It may also be an indication that the enemas administered with those tubes did not contain the substances we tested for. It also is possible that the bone tubes sampled were not part of enema syringes but were used for another purpose.

As is often the case, this study has raised some interesting ideas and as many questions as answers regarding the kinds of plants and concoctions used in cave rituals. In the future it will be worth exploring the possibility that willow featured prominently in cave and water-related ritual practices. The same can be said for the role of vanilla. The results of analyses on samples collected from bone tubes were not particularly enlightening. Since their function still remains to be clearly understood, they are worthy of additional exploration. All of these questions and others can be productively addressed through absorbed residue studies.

Acknowledgements

We would like to extend of gratitude to the Belize Institute of Archaeology for their continued support of our research at Pacbitun. In particular, Dr. John Morris is thanked for his encouragement over the years. We would like to thank the Alphawood Foundation for the funds that have supported this research. We also would like to acknowledge the support of the University of South Carolina, Kennesaw State University, and California State University San Marcos.

13

The Pacbitun Causeway System: Investigations of a Ritual Landscape

Jennifer U. Weber and Jon Spenard

Functioning as transportation corridors and communication routes, and reflecting social and political activities, ancient Maya causeways can provide insights into political activities, social organizations, economic structures, and cosmological values at the site and regional levels (Normark 2006; Shaw 2008). First identified by Healy (1990a), but investigated with the initiation of PRAP, Pacbitun has a complex causeway system that extends from the site core deep into the periphery (see chapter one, this volume; Weber 2011, 2013; Weber and Powis 2011; J. Weber *et al*. 2012). To date, the system is known to incorporate three causeways: Mai Causeway, Tzul Causeway, and Tzib Causeway (Weber 2011; Weber and Powis 2011; J. Weber *et al*. 2012). We have employed multiple forms of archaeological methods in its investigation. For understanding its construction history, we have conducted stratigraphic and clearing excavations. For mapping it in its entirety, we have employed a mix of traditional survey, terrestrial laser scanning (TLS), and the analysis of aerial LiDAR (Light Detection and Ranging). This chapter provides an overview of the research that has been conducted on the Pacbitun Causeway System for determining the relationship between the site centre, the causeway system, and the caves in the Pacbitun periphery, which enhance our understanding of the site's ritual landscape.

A Different World – The Pacbitun Periphery

Proper archaeological investigations at Pacbitun started in the 1980s with Paul Healy of Trent University (see chapter two, this volume). His team recorded and mapped two causeways (Mai and Tzul) during the 1986 and 1987 field seasons (Healy 1990a:250). Later, in 2009, researchers identified twelve caves, located within 3 kms of Pacbitun, three of which, Actun Merech, Actun Pech, and Tzul's Cave, were preliminarily mapped (see chapter ten, this volume; Powis 2010, Weber and Powis 2011). In 2010, the senior author started her research at Pacbitun with the goal of surveying the area between Pacbitun's site core and the three previously investigated caves. Due to its proximity to the other three surveyed caves, a fourth, Crystal Palace, was added to the area of investigation (Weber 2011). This was the first of many archaeological excursions into the Pacbitun hinterlands. Since then, traces of the ancient Maya who lived in close vicinity to Pacbitun have been found in the form of housemounds, agricultural terracing, constructed water reservoirs, wells, and chultuns (Spenard 2014; Spenard *et al*. 2012a; Weber 2011, J. Weber *et al*. 2012). Healy (1990a) had initially noted that Tzul Causeway appeared to extend approximately 1000 m southwest from the Pacbitun site core. The 2010 survey revealed that the causeway seemed to terminate in front of Tzul's Cave. The survey also unveiled an additional causeway, designated as Tzib Causeway, which crosses Tzul Causeway (Weber 2011). This survey was followed by archaeological investigations in 2011, 2012, and 2013, which helped paint a more complete picture of the Pacbitun Causeway System (Weber 2011, 2013, 2014, Weber *et al* 2012).

The Pacbitun Causeway System

As mentioned, three named causeways are present at Pacbitun: Mai Causeway, Tzul Causeway, and Tzib Causeway. In the Pacbitun site core, the Mai Causeway begins adjacent to Structure 11 where it connects with the Tzul Causeway. From there, it runs east for approximately 273 m, before terminating in front of Structure 10. The Tzul Causeway also starts at Structure 11 heading in a southwesterly direction for approximately 1.4 kms where it intersects with another ancient Maya road named the Tzib Causeway. Beyond this confluence, Tzul Causeway continues with a turn to the south into the foothills for about 1.2 kms and terminates near the entrance of Tzul's Cave (Figure 13.1). That cavern penetrates a natural terrace approximately half-way up a low hill above a seasonally active creek. It is a restricted cavern consisting of three horizontal tube-like passages connected to one another by vertical drops. The explored portion of the cave has six known chambers, measures approximately 35 m in length and is shaped roughly like the letter 'V' (see chapter ten, this volume; Powis 2010; Spenard *et al*. 2018; Spenard and Mirro 2017, 2018). In total, Tzul Causeway is approximately 2.6 kms long. Tzib Causeway is much shorter, only about 600 m in length, and connects a plazuela group to a minor centre (Weber 2011).

Ancient Maya Causeways and the Ritual Landscape

Causeway Morphology

When the ancient Maya decided to build causeways they created raised roads or built-up walkways. The most commonly used word for them in the Maya area is the Yucatec Mayan term sacbe (plural: sacbeob), which can be divided into the morphemes 'sac' and 'be', translating into 'white' and 'road', respectively (Keller 2006, Normark 2006; Schwake 1999; Shaw 2001, 2008; Villa Rojas 1934).

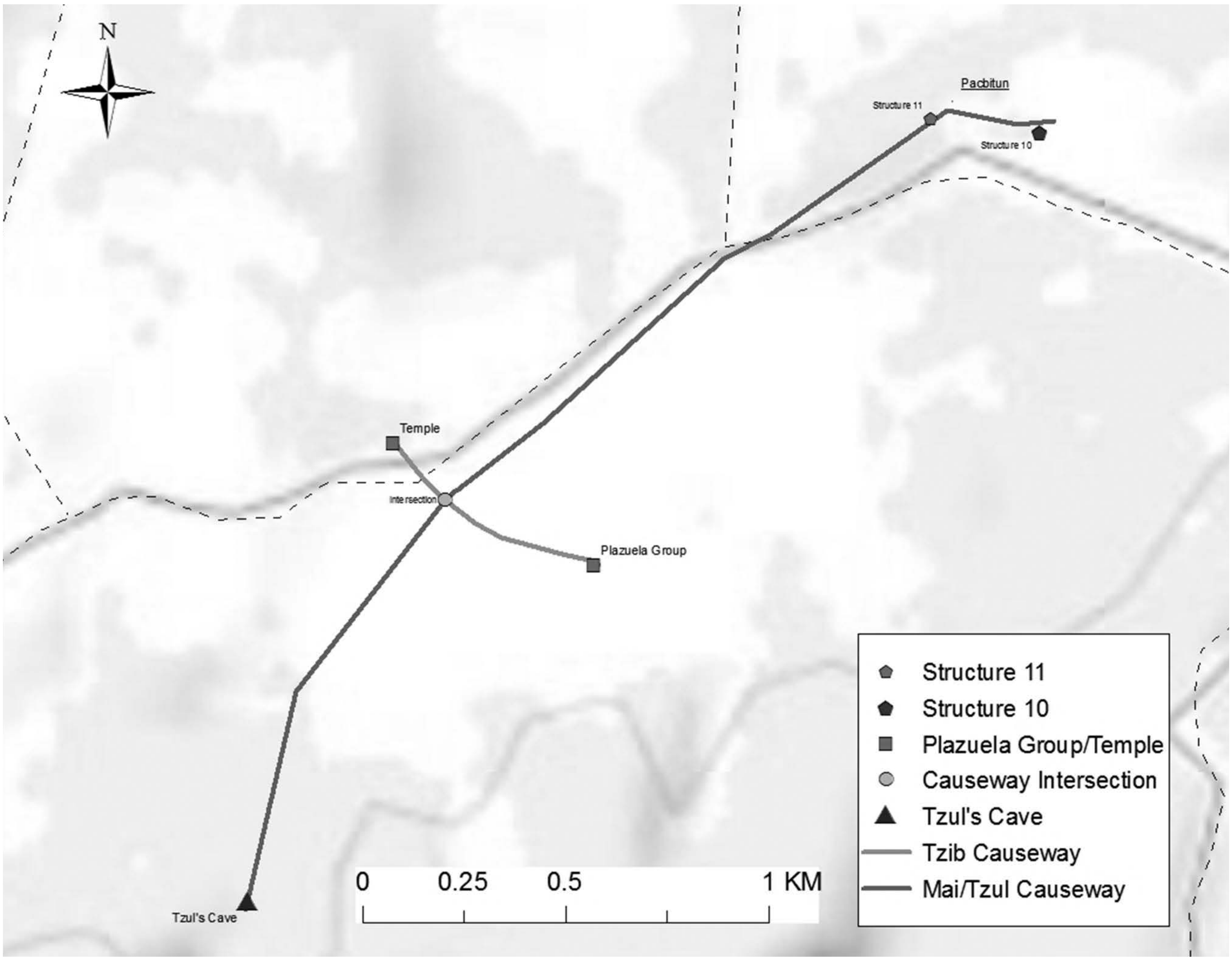

Figure 13.1. The Pacbitun Causeway System.

The term 'white' here refers to the colour of the limestone bedrock foundation which lies at the geologic base of the Maya lowlands. Generally, these causeways consisted of dry-laid boulders at the base, topped with cobbles and filled in with gravel. The construction was then plastered with powdered limestone, hence the term 'white road' (e.g., Keller 2006, Normark 2006; Schwake 1999; Shaw 2001, 2008). Regarding their descriptive patterns, ancient Maya causeways have been found in a variety of shapes, lengths, forms, and geographical areas. They have been classified into two basic categories: intra-site causeways and the inter-site causeways (Keller 2006; Normark 2006, Stanton and Freidel 2005). However, archaeologists have begun to develop more refined classifications for Maya roads focusing on their morphology and length of the road or the distance between the features connected by the roads (Bolles and Folan 2001; Normark 2006; Schwake 1999; Shaw 2008).

Causeway Symbology and the Ritual Landscape

Many archaeologists have noted causeways reflected different levels of social and economic activity and meaning (Chase and Chase 2001; Cheetham and Awe 2004; Hutson and Welch 2014; Normark 2006; Shaw 2008). While the roadways increased the ease of commerce and transportation, they were not necessarily needed in all the places they have been found (Hutson and Welch 2014). Thus, these roads might have also served as displays of religious and political symbology (Hutson and Welch 2014; Keller 2006; Normark 2006; Schwake 1999; Shaw 2008). Palka (2014:95) argues that travel on ancient Maya causeways should be seen as a form of meeting, or coming together, with the temples or plazas they lead to, rather than viewing them as destination points. So, questions asking why a causeway was constructed in the first place should be answered by not only focusing on the physical constructed remnants we observe today but also take into account other, less visible connections (e.g., social, physical, political, or cosmological) (Normark 2004; Shaw 2008:134). The same should be considered for areas not connected by causeways. It can therefore be beneficial to turn our attention to the landscape on which the roads were constructed.

Throughout pre-Hispanic Mesoamerican history, caves, mountains, and the waters in them were considered vital landmarks for community formation, settlement patterning (Garcia-Zambrano 1994), and ritual practice, and were at the foundation of what has been described as the Hard Core of Mesoamerican Cosmology (Lopez Austin 2001). The need for incorporating these landmarks into settlements was so potent that where they did not exist naturally, people created them (Brady and Veni 1992). For example, at Teotihuacan, the pyramids of the Sun, Moon, and probably the Feathered Serpent replicated mountains and artificial caves were excavated beneath each when built (Heyden 1973; 1975; 1981, 2000; Manzanilla 2000; Manzanilla *et al*. 1994). This practice has also been documented in Acatzingo Viejo, Mexico (Aguilar *et al*. 2005), and throughout the Guatemalan highlands (Brady and Veni 1992; Woodfill 2014).

The earth and all of its topographic features were considered to be alive and, as living beings, to interact in human affairs (Brady and Prufer 2005; Spenard 2006, 2014; Stone 1995:21; Taube 2001). Caves and mountains were especially potent places of the sacred Earth, which is considered to be the primordial source of all abundance and fertility (Brady and Prufer 2005; Moyes *et al*. 2009:177). In various contemporary Maya myths, the Earth itself was seen as the body of a divine being (Adams and Brady 2005; Danien 2005; Stone 1995:21). In association with mountains, caves were seen as houses, cosmic entry and exit points, places of transformation, and sources of fertility and material wealth, as well as sources for water (Astor-Aguilera 2009, 2010; Brady 1988, 1989; Ishihara-Brito 2007, 2008; Rissolo 2003b; Slater 2014; Stone 1995:34-40; Spenard 2014; Taube 2001, 2003b).

From the perspectives of physical geology and symbolic thought, caves were and remain intimately associated with water in the Maya area and broader Mesoamerica (Brady and Ashmore 1999). Much of the Maya region is underlain by karstified limestone, into and out of which water flows in the form of rivers, streams, creeks, and springs; moreover, as rainwater percolates through the ground it drips from the ceilings of caves creating great formations. Archaeological, iconographic, and ethnographic studies from throughout Mesoamerica have demonstrated a close relationship between rain and caves, and speleothems in particular (Bassie-Sweet 1991:152; Brady 1999:63; Fitzsimmons 2005; Josserand and Hopkins 2007; Navarrete and Martinez 1977; Seler 1901:163-169; Stone 2005). For example, a high percentage of pre-Hispanic and contemporary stone effigies of the rain god, both carved and unmodified, were made from cave formations (Brady 1999:65-66). In Cueva de los Andasolos, Chiapas, archaeologists discovered two speleothems that had been carved to represent anthropomorphic figures, one of which was a full body, the other a cluster of simple faces (Navarrete and Martinez 1977). Such faces were frequently carved near sources of water, particularly in cenotes, suggesting connections to the rain god (Rissolo 2005:81; Strecker 1985:20). In the entrance of La Pailita Cave, Guatemala, the Maya created, out of limestone rock and stucco, a statue of Chahk seated on a throne adjacent to a large columnar formation indicating that this location was his domicile (Graham 1997; Stuart and Stuart 1977:53). The numerous censers decorated with the visage of the Central Mexican rain god, Tlaloc, found in Balankanche in Yucatan, were placed around a large stalagmitic column deep in the cave (Andrews 1970). At Tumben-Naranjál, Quintana Roo, speleothems were regular components of offerings at rain shrines (Lorenzen 1999:102).

Mountains were also perceived as water receptacles in Mesoamerican thought, and rain clouds were often depicted in art rising up to the sky as billowing, aromatic smoke-like breath exhaled from zoomorphic caves, such as at Chalcatzingo, Mexico, and the San Bartolo North Wall mural, Guatemala (Broda 1991:84; Taube 2001:104; Taube *et al*. 2010). For contemporary Maya in Chichicastenango, Guatemala, stone effigies, possibly speleothems, are associated with wind and tempests, which are considered to be the destructive aspects of rain (Brady 1999:65; Bunzel 1952:268). Lacandon Maya place small stones that had been taken from the sacred abodes of deities into censers called god pots (McGee 1990:52; Soustelle 1961; Tozzer 1907:87). The stones are variably referred to as mediums or thrones for the god whose residence it was taken from, and they allow the Lacandon to communicate with those beings (McGee 1990:52). Among the Nuyoo Mixtec of Oaxaca, the saints of rain are believed to live in caves in water-filled mountains, and the shrines of these supernaturals are frequently found in caverns with pools or that have active drip formations, the latter of which is considered precipitation (Monaghan 1995:106-108). Additionally, speleothems are treated as the rain god and are presented with offerings accordingly by Mixtec in general (Ravicz and Romney 1969:394). In the Late Postclassic period, Aztec and contemporary Central Mexican communities had myths of gods who collect and store jars of water in their mountain caves, which they then pour out as rain over the land (Rands 1955:344). In the *Titles of Tetzcotzingo*, the king, Nezahualcoatl, mentions that the hills surrounding the Valley of Mexico are filled with water (McAfee and Barlow 1946). Furthermore, the Aztec called mountains, *atoyatl*, ‘running water,’ in reference to the rivers that flow from them (Townsend 1992:181). That same king transformed Tetzcotzingo mountain into a rain and water shrine as part of a royal pleasure park (Evans 2000; Townsend 1982). They also believed that mountains could dissolve if necessary, releasing enough water to flood the world (Sahagun 1963:247).

The fact that many caves provide access to water sources certainly played into their significance as part of the ritual landscape for the Maya. Rain and water are critical for agriculture. Brady and Prufer (2005:369) note that for an agriculturally-based society, fertility is an immediate and never-ending concern in relation to crops, hence the most important elements for crops are soil and rain which, of course, happen to occur around mountain ranges housing caves. Consequently, caves and mountains were believed to house Earth forces, particularly rain and were associated with origin myths (Astor-Aguilera 2009, 2010). Upwards of 1,000 caves are known in Belize, and almost all of them show evidence of ritual usage. Around Pacbitun, approximately 70 caverns are known, almost all of which occur in the first range of foothills to the south of Pacbitun, suggesting the total is much higher (see chapter ten, this volume; Spenard 2014). Such an abundance of caves does beg the question, did the landscape play a role in the settlement location choice of the first residents of Pacbitun. For example, ancient settlement in the Yucatan is often centred around caves and waterholes, which not only allows for access to water but also to the ritual place (Fedick *et al*. 2012; Hutson and Welch 2014:431). Undoubtedly, the caves played a vital part in the religious lives of ancient Maya people living around Pacbitun (see chapter ten, this volume; Spenard 2014).

Investigating the Pacbitun Causeway System

Causeways in association with caves are less common than causeways connecting architecture or settlements, but they have been found at other sites as well (Shaw 2008). Considering the vast number of ritually-used caves in the Pacbitun periphery, a closer look at why the Maya built a causeway to near the entrance of Tzul's Cave and not any of the others is certainly warranted. Another intriguing aspect of the causeway system at Pacbitun is the intersection between Tzul and Tzib Causeways. Intersections in causeways are referred to as 'hol' which can be translated as 'crossroads', and often served as a way to connect terminal architectural groups with a more well-defined site core (Shaw 2008). Mathews and Garber (2004) argue that these crossroads also carried directional symbolism and played an important part in Maya ideology.

In order to further investigate possible construction intent, as well as directional symbolism, the Pacbitun causeway research focused on three overall objectives: (a) to ascertain the construction periods of the causeway system and its corresponding architecture; (b) to determine its political, social, economic, and/or religious function and relationship to other structures located in the site core, as well as to other structures located in the periphery (i.e., either alongside the causeway or at the opposite end); and (c) to determine the role of the associated caves and who controlled access to them. This can be summarised in one major question: Did the causeways simply connect pre-existing structures or did they develop in a more organic way, following societal developments.

Following the initial survey and recording of the causeways, we focused our field research on excavations into the peripheral causeway intersection, connecting Tzul and Mai Causeways, as well as excavations into a mound adjacent to Crystal Palace Cave. We also examined the nature and chronology of the causeways and their associated buildings. Within the site core, we therefore targeted the only termini complex at the site, Structure 10, as well as sections of the Mai and Tzul Causeways. Outside the site core, we focused on the peripheral Tzib Causeway, which connects a plazuela group to a minor centre, as well as portions of Tzul Causeway in front of Tzul's Cave.

Periphery Zone Investigations

Tzul and Tzib Causeways

Archaeological investigations at the Tzul/Tzib Causeway intersection were targeted towards construction style and development. Overall, the degree of preservation of the causeways in and around Pacbitun varies greatly. This is in part due to erosion, but also because the contemporary village of San Antonio occupies the same land. While in some locations clear rock alignments were encountered above ground, in others, especially around the causeway intersection, the ground has been extremely disturbed by contemporary life. For example, while Tzib Causeway clearly starts or ends at the intersection, its directional course running northwest is hardly traceable above ground for approximately 100 m because it runs through an active agricultural field that was partially razed by the main road in the village. Heading into Pacbitun's periphery past the modern road, the causeway becomes increasingly more visible before terminating in front of a minor centre. All four causeway sections emerging out of the intersection vary in terms of their visibility above ground. Shovel test pits and excavation units were placed into each of the causeways at varying intervals to uncover each and expose their various construction fill types These investigations were complemented when PRAP acquired Light Detection and Ranging (LiDAR) data from the West-Central Belize LiDAR Survey (Weber and Micheletti 2016). The derived imagery was able to confirm the surveyed and excavated causeway intersection (Figures 13.2 and 13.3).

The two structures on either side of Tzib Causeway are certainly of interest in regards to the analysis of Tzib Causeway itself. Since they have not been excavated to date, we can only speculate about their function, relation to the causeway, and connection to Pacbitun. Cheetham (2004) notes that temple buildings would often start out as small ceremonial sites and transform into terminus groups. For the elite residing in the nearby site centre it would be of interest to incorporate these groups by linking them to the site core and expanding their realm of power (Cheetham 2004). Since they relied on subsistence and labour from the domestic population living in the periphery, direct control of the surrounding area was of vital importance. The display of power in this periphery was a crucial necessity to solidify their dominance (Cheetham 2004). The Tzib Causeway provides a good example for this kind of development. The housemound distribution in the periphery of Pacbitun is clustered just south of the intersection of Tzul and Tzib Causeways. More importantly, the Tzul Causeway is also located in close proximity to four artificial water reservoirs, or aguadas. Close water sources are certainly vital for farming, and settlement in close proximity to them is a logical consequence found in ancient agricultural settlement patterns. Elites residing in the Pacbitun site core most likely relied on food provided by these farmers and had an interest in securing their loyalty to the site centre (Weber 2011).

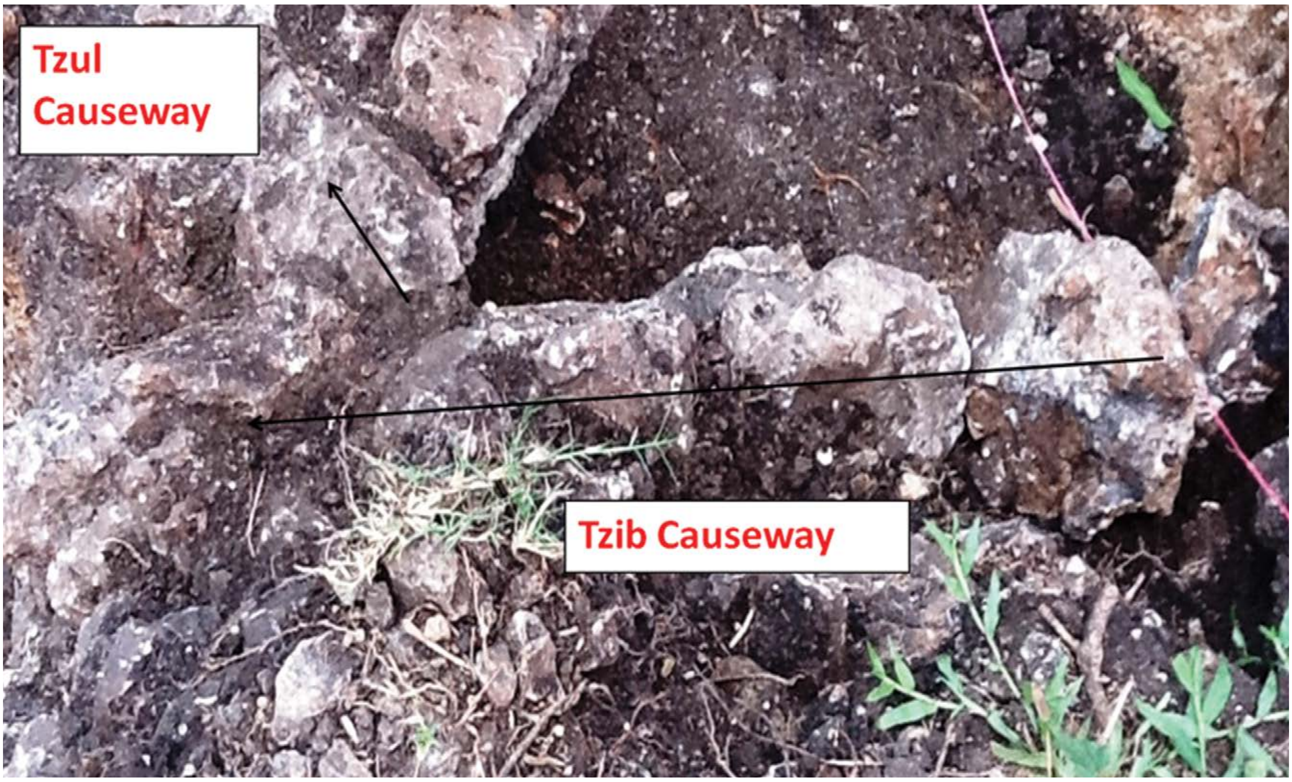

Figure 13.2. Excavated ground boulders of Tzib Causeway showing directional alignment (Weber and Powis, 2013).

As with the Zopilote Group at Cahal Pech, which was integrated into the site core by a causeway, the architectural complexes at either end of Tzib Causeway might have started out as outlying ritual centres that were later integrated into the site core through the Tzib Causeway (Cheetham and Awe 2004; Cheetham *et al*. 1993). Shaw (2008) agrees that a causeway, with practical and symbolic functions, would have been the perfect project for elites seeking to integrate and manage the outlying population. The process of building major causeways could have served as a way to unify workers and establish a collective identity that would further the establishment of the territory as a single polity (Ashmore 1992; Shaw 2008). Ashmore (1992) states that while causeways might have served as unifying mediums they would have also emphasised to any passengers the role and importance of the structures at its end (Cheetham 2004; Cheetham *et al*. 1993). For Cheetham and Awe (2004), these causeway-connected structures served as a functional continuation of the site core, rather than a cosmological layout design. One can argue that the addition of the causeway to the isolated structure created a new, cosmological entity that carried new meaning. For example, the earlier ideologies of the termini complex and plazuela group as periphery

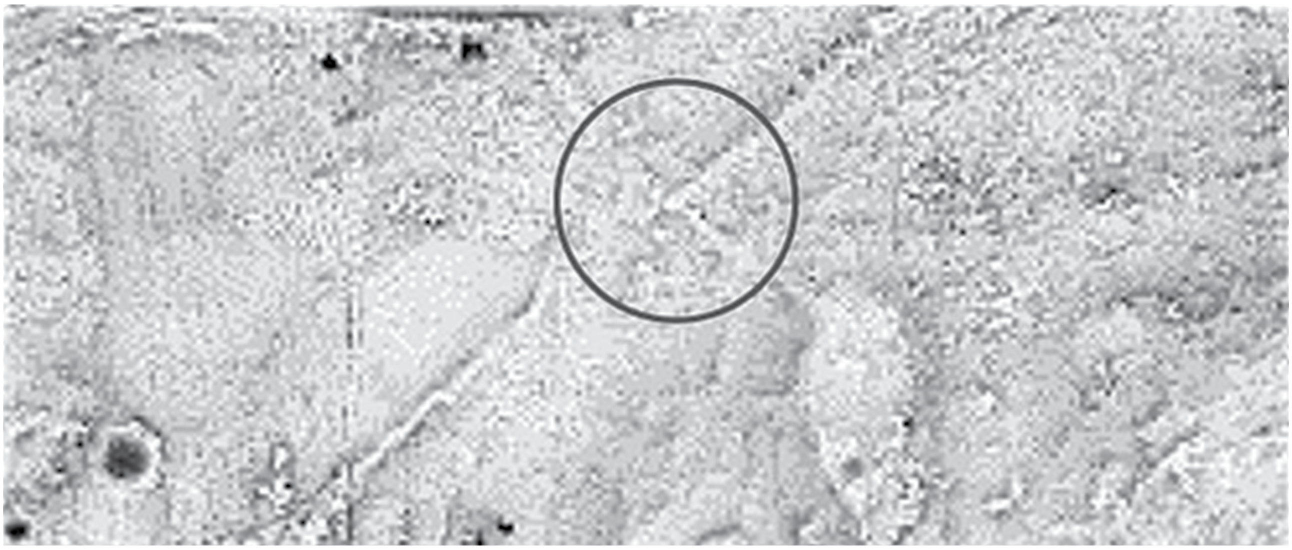

Figure 13.3. Causeway intersection close up (circled in black) on imagery derived from LiDAR data with applied Skyview Factor.

zone ceremonial structures were transformed into a new assemblage or ideological territory once they were connected through Tzib Causeway to the site core (Weber 2011). Perhaps, the political and/or practical incentives that led to the incorporation of hinterland structures into the site core were eventually forgotten as, over time, the newly formed intersection gained ideologic meaning (Normark 2006; Weber 2011).

On the other hand, if we follow the argument of site incorporation, then we have to look towards other important structures surrounding the causeways. During the 2010 survey, we recorded a plazuela group which lies just south of Tzul's Cave. The structures are accompanied by what seem to be remnants of a wall, as well as a chultun covered by slate slabs (Weber 2011). During later field seasons, we noted that although the constructed Tzul Causeway seems to end in front of Tzul's Cave, a passage appears to continue towards a large rock wall (Figure 13.4). Following the loose path beyond the rock wall confirmed the suspicion that it leads to the plazuela group and its associated features. Thus, Tzul Causeway might have been built to incorporate that plazuela group into the domain of Pacbitun (Weber 2013). Alternatively, if we consider the valley as a whole, we see that the causeway may be making a much stronger statement of elite control than originally believed.

Tzul's Cave is only one of several karst features in the valley in which it sits. At least six others are known in its vicinity, many of which comprise the largest-known landscape drainage system in the Pacbitun region (Hollings 1996; Spenard and Mirro 2017). The two caverns archaeologically investigated in the valley, Tzul's Cave and Slate Cave, both show evidence of water-related rituals being performed in them (see chapter ten, this volume). Moreover, on the hilltop directly above the primary inlet of that underground system is the minor centre of Sak Pol Pak, a secondary settlement with the largest known pyramidal structure outside of Pacbitun's Core Zone (Conlon 1999; Spenard 2014; Spenard *et al.* 2012b; Spenard and Powis 2018). Spenard and Powis (2018) note that ritual use of the hilltop long predates the first domestic architecture of the minor centre by several centuries. But, the earliest phase of the temple pyramid was constructed on the hilltop during the Tzul phase of the Early Classic period (see Table 1.1, this volume), and ceramics from the earlier Puc and Ku phases were recovered from mixed contexts. The first domestic architecture was not constructed until several hundred years later during the Coc and Tzib phases of the last few centuries of the Classic period when most of the causeway construction occurred (Weber 2011, 2012, 2013). Collectively, these data suggest the hilltop was a ritually-charged location early in Pacbitun's history and retained that status until the region was abandoned. Spenard and Powis (2018) note that when considering the importance of mountains, caves, and water in Mesoamerican cosmology, and the ritual location of Sak Pol Pak set directly on top of the entrance to the main landscape drain in the Pacbitun region, the hill was likely to be seen by the inhabitants of the site as the main water mountain with the surrounding karst features serving as the main source of rain. As such, the hilltop and the pyramid likely served as the primary rain shrine for the community. Regardless of exactly where Tzul's Causeway ends, whether near the entrance to Tzul's cave, the smaller plaza group uphill from it, or even beyond that, it terminates within the entrance to the large valley, providing a direct connection between it and Pacbitun's site core. Almost assuredly, the causeway was a strong statement of control by the nobility from that centre over the life-giving rains that were believed to come from there (Spenard and Powis 2018).

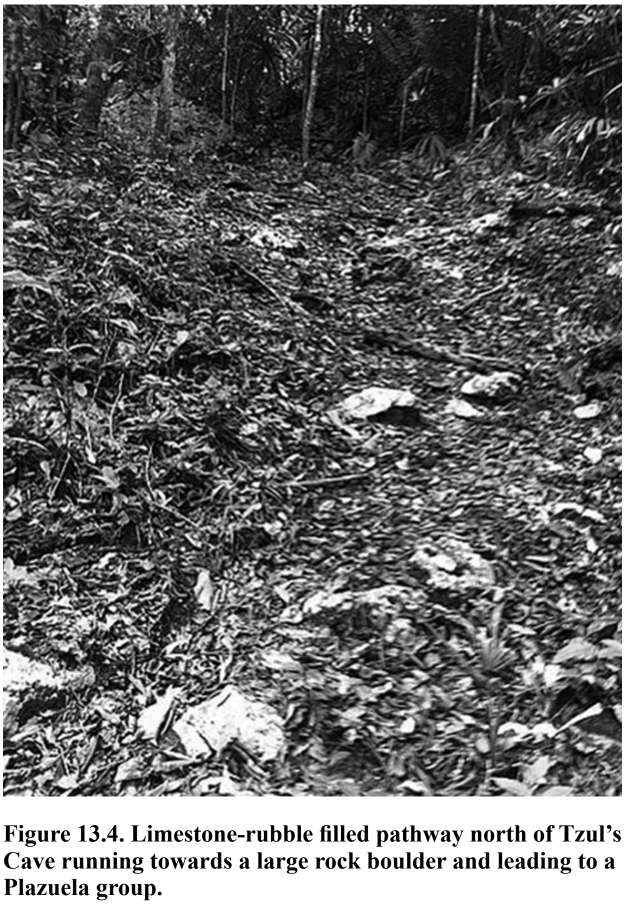

Figure 13.4. Limestone-rubble filled pathway north of Tzul's Cave running towards a large rock boulder and leading to a Plazuela group.

Crystal Palace Mound

The Pacbitun Maya used Crystal Palace Cave for ritual purposes (see chapter ten, this volume; Powis 2010; Spenard and Mirro 2017, 2018; Spenard *et al.* 2018); however, no causeway or ancient pathway leading to this cave has been identified. Cheetham and Awe (2004) hypothesise that a reason why some peripheral architecture received a causeway connection while others did not might have been the presence of prior resident populations at some locations who had earned the seasoned right and seniority to oppose integration to the site core. Thus, if the cave's ritual significance to the people around Pacbitun predated the use of Crystal Palace Cave, this might have prevented the elite at the site core from establishing control over its access by building a road to it. A rubble mound, designated as Crystal Palace Mound, was encountered in very close proximity to the cave and might have served as a special purpose building. Excavations revealed quite a few intriguing artefacts, including a ceremonial chert blade, as well as obsidian blades, findings that indeed suggest that this mound was a location where ritual functions took place. Considering the close location to Crystal Palace Cave, this location could have served as a contact point for people entering or exiting the cavern (Weber 2013, 2014).

Site Core Excavations

Structure 10 and Mai Causeway

Structure 10 is a pyramidal structure to the east of the site core. It is approximately 8 m high and 13 m wide and connected to the site centre by the Mai Causeway, making it a termini complex architectural arrangement (Chase and Chase 2003; Cheetham and Awe 2004; Keller 2006). The causeway is approximately 273 m long and 7 m wide. Starting from Structure 11 in the site core, it runs east for 190 m at a circa 120-degree bearing before changing direction to almost 90-degrees for the remaining 83 m where it terminates at the foot of Structure 10 (Weber 2011, 2013). With a total distance of less than 300 m, the causeway can be characterized as 'local intra-site' according to Shaw's (2001, 2008) classification system.

At the base of Structure 10, the Maya placed a dedicatory cache, designated as Cache 1. The offering consisted of two large Late Classic period polychrome dishes (rim diameters for each measured 53 cm) placed lip-to-lip (Figure 13.5). Inside the vessels were a speleothem fragment, a spondylus shell, as well as human skeletal remains (Weber and Kieffer 2013).

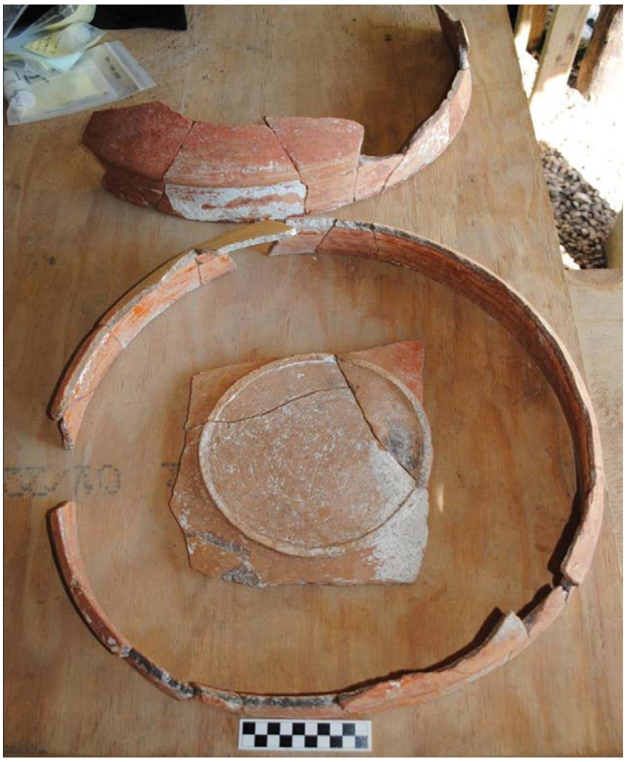

Figure 13.5. Cache 1 vessel from Structure 10.

Tzul Causeway in the Site Core

PRAP's survey of the causeway system revealed that Tzul Causeway's layout directly south of the site core differed from that originally recorded by Healy (1990a). As reported, it starts to the east of Structure 25 and then runs in a southwesterly direction into the periphery (Healy 1990a). Our research has identified two possible separate sections of the causeway rather than one previously identified. One causeway appears to be running from the east of the site core, possibly from Structure 11, passing closely behind Structures 26 and 28 before terminating into the back of Structure 30. To test its potential advantages in terms of time and accuracy over traditional recording practices, we conducted a TLS survey during the 2012 and 2013 summer field seasons, detailing the site's structures, plazas, and causeways (Weber and Powis 2014). With this method we could confirm the adjusted Pacbitun Causeway System in the site core which is no longer visible to the naked eye. The causeway behind Structure 26 was clearly visible through the scanning data (Figure 13.6). We also discovered what appeared to be an 'off-ramp' from the south side of Structure 30 which extends southwest into the periphery. Excavations into that ramp, labelled as Southwest Passage (SWP), yielded a high volume of artefacts consisting of ceramic sherds, lithics, *jute*, shell, groundstone, obsidian blade fragments, as well as disarticulated human remains suggesting it was secondary fill (Weber 2013). The retaining walls consisted of cobble construction rather than boulder alignments. The only cut stones noted were at the northern end of the walkway where it runs into Tzul Causeway (J. Weber *et al*. 2012). There, we uncovered three boulders aligned east-west. The construction fill was concentrated on the eastern side of the unit, which we speculate was to create a level walkway with the natural topography of the hill (Figure 13.7). Keller (2006) encountered a similar structure at Chaaca Patio in Xunantunich, called the Northeast Walkway. That structure also consisted of mixed ceramic and lithic fill built upon natural soil, rather than directly on bedrock. As with the Northeast Walkway recorded in Xunantunich (Keller 2006), the Pacbitun SW Passage likely served as the primary access to the site core. Its east-west alignment suggests a route into the settled periphery and would have likely served as the entrance and exit point, defining traffic flow in and out of the site core (Weber 2013). Preliminary analysis of the obtained LiDAR imagery later confirmed the SW Passage within the site core, as well as the missing Tzul Causeway sections, reshaping our understanding of the causeway layout within the Pacbitun site core significantly (Figure 13.8).

Conclusions

Pacbitun presents us with a complex, multi-purpose causeway system whose use and meaning likely changed through time. The presence of causeways in general and

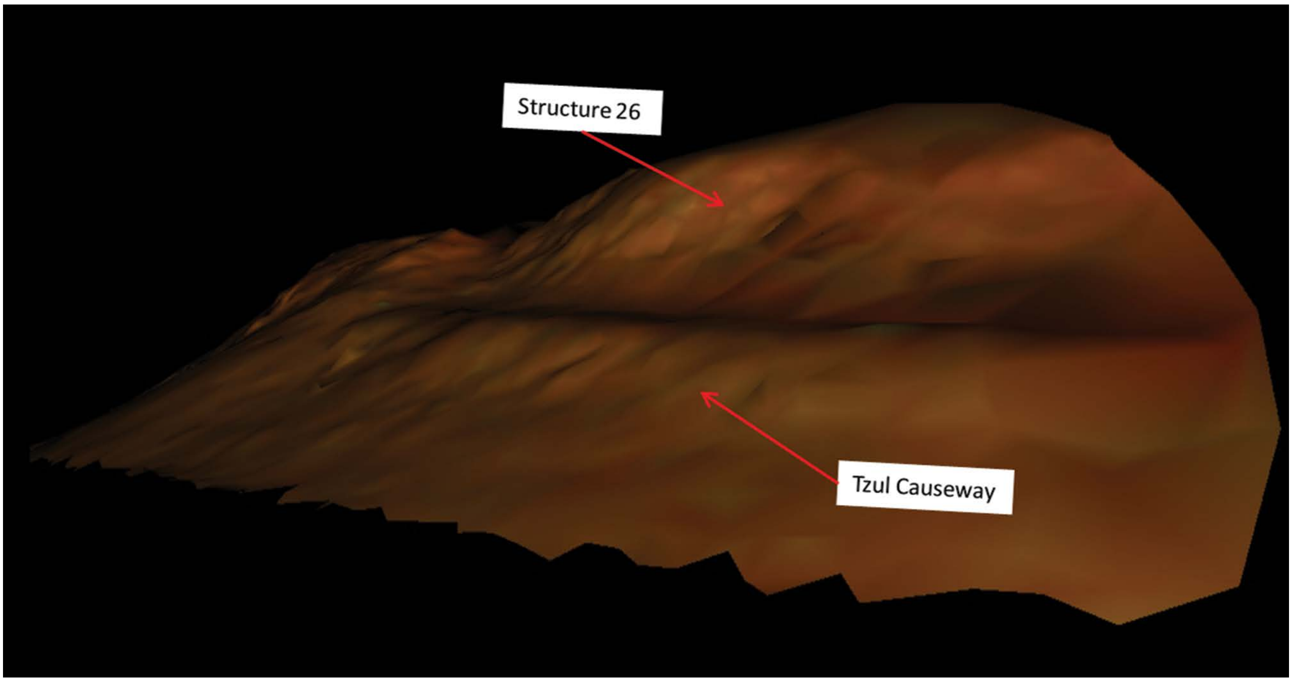

Figure 13.6. Causeway feature running behind Structure 27.

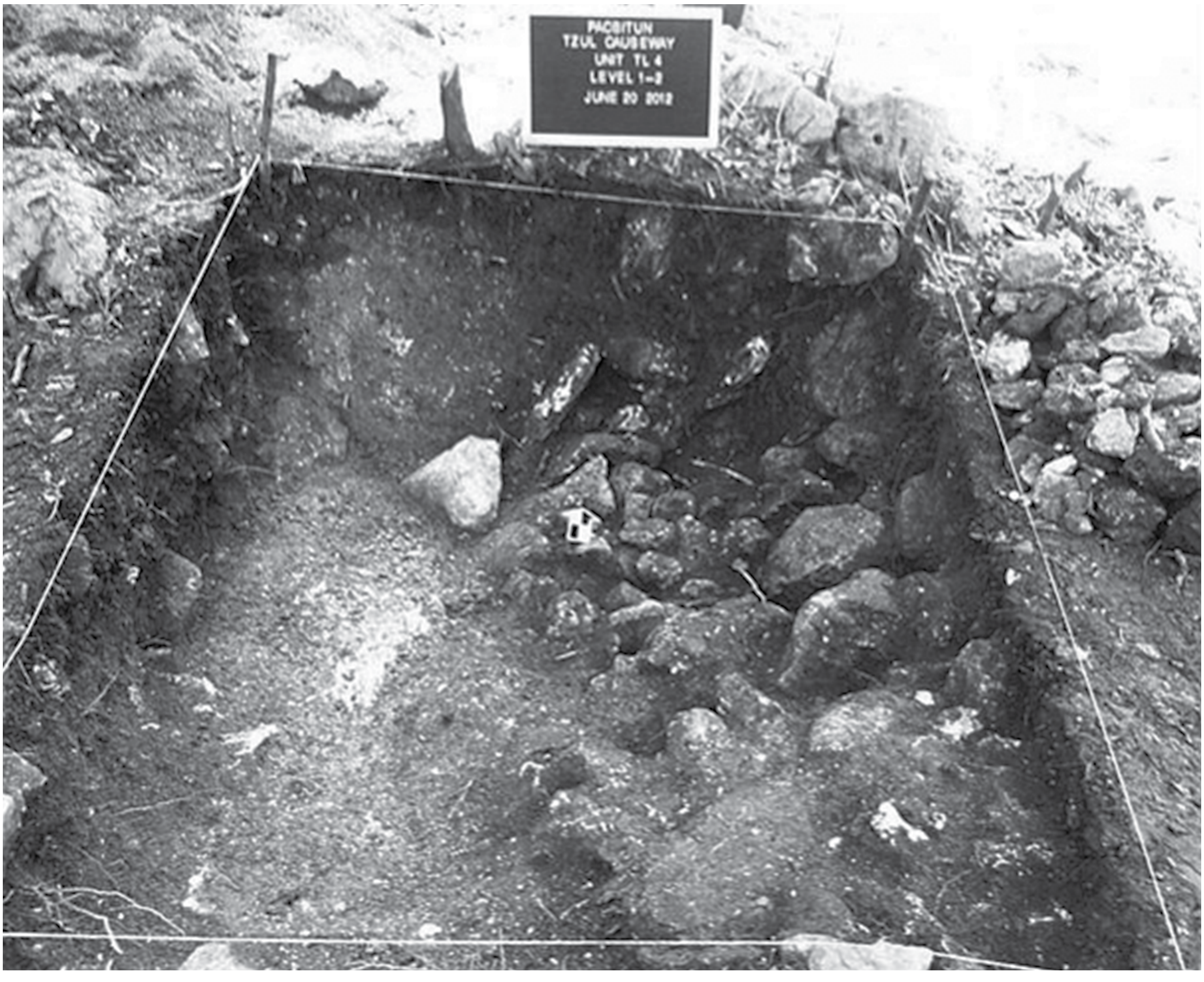

Figure 13.7. SW Passage displaying levelling fill to the east.

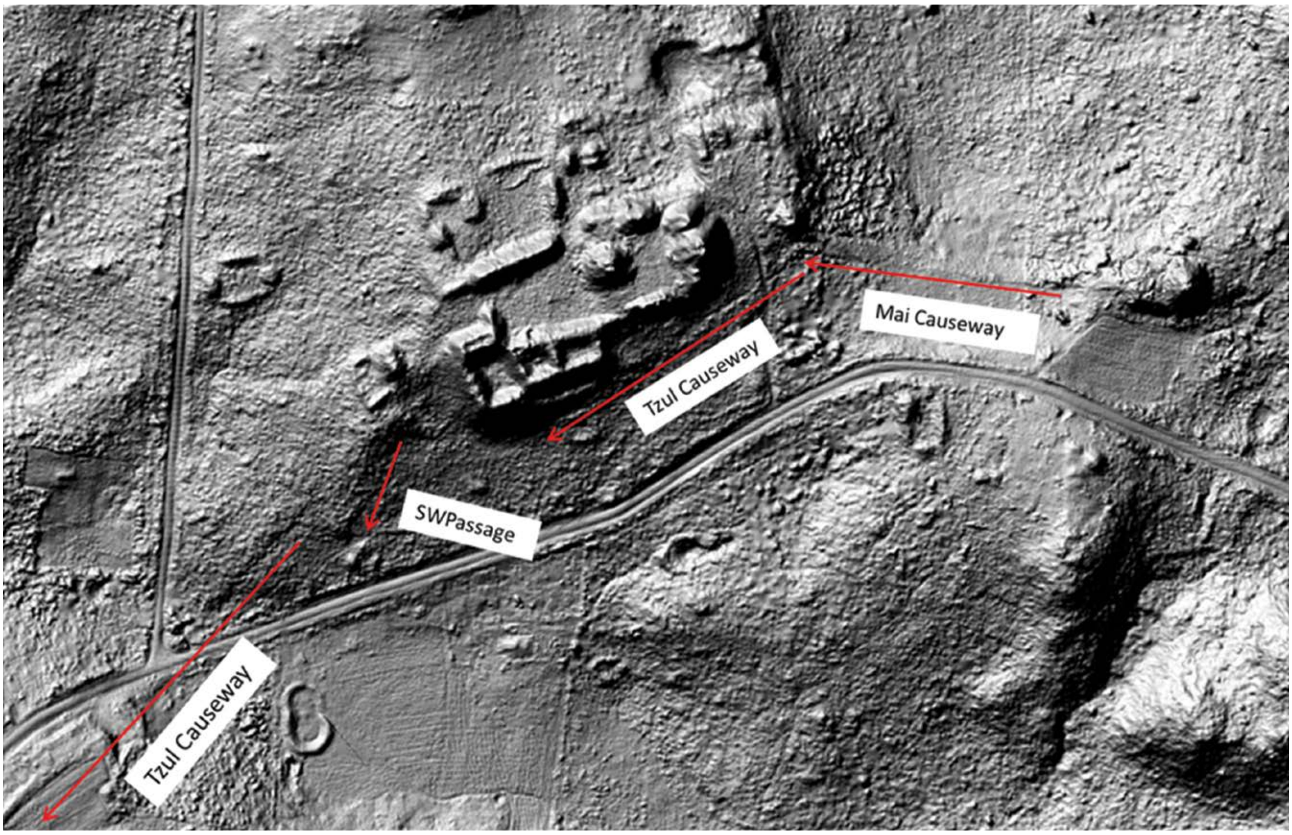

Figure 13.8. Corrected Causeway System within the site core depicted by LiDAR imagery.

the termination of Tzul Causeway near Tzul's Cave in particular, certainly poses many questions about Pacbitun's socio-political development. As noted above, behind a practical aspect for causeway constructions certainly lies a political and ideological building intent. A road like Tzul Causeway which connected the site centre to the domestic population, ensured easy transportation of subsistence goods and stood as a symbol of power domination. That road's connection to a water-filled valley that was likely understood as the primary source of rain for the Pacbitun community would have significantly bolstered those power claims through claiming ownership or control over that space. Tzib Causeway, along with its minor centre and plazuela group, could have been connected for the same purpose at a later time, further establishing a visible and prominent link to the site centre. These links, displayed in the presence of causeways, become even more apparent in the absence of roads at other culturally used locations, like Crystal Palace Cave (Weber 2014). Mai Causeway certainly presents the potential for various arguments in regards to political and ideological changes that occurred at Pacbitun towards the Late Classic period. What could have caused the need to build a road from the site core to Structure 10, which we argue served already as a portrayal of political dominance at some point? Was the Mai Causeway constructed to put emphasis of the religious dominance of the elite residing at Pacbitun? If so, why did this become necessary? And what were the changes that Tzul Causeway underwent (Weber 2013)? Further analysis of the various sources of data in and around the Pacbitun Causeway System will hopefully aid in additional analysis of the site's development and increase our understanding of the ancient Maya people who once lived in and around Pacbitun and its hinterlands.

Acknowledgements

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14

Identification of an Ancient Maya Groundstone Production Site in the Periphery of Pacbitun, Belize

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Nicaela Cartagena, and Terry G. Powis

Groundstone artefacts, including manos and metates, occur across the Mesoamerican region starting from the time of the earliest settled villages. Despite widespread use of manos and metates in Mesoamerica, only a limited amount of direct archaeological evidence has been found related to the manufacture of these groundstone artefacts. Although some quarry locations have been located in Mexico (Cook 1973; Searcy and Pitezel 2017), these are very limited in archaeological materials, or are from only extrusive igneous rock quarries with different physical properties than other types of igneous rock like granite. Additionally, the extraction sites may have significantly different archaeological features from sites where only working or shaping the final product of the rock is performed.

The lack of direct archaeological evidence for production of granite groundstone artefacts in Mesoamerica has, until now, limited our understanding of raw material acquisition from different rock sources, techniques of manufacture, disposal of production waste, and trade or marketplace distribution of granite manos and metates in the ancient Maya world. In Belize, the mano and metate can take a number of forms, but the most common (two handed mano with square or rounded form on a turtle back metate form) is pictured in Figure 14.1. The recent discovery of a production area with 220 granite mano and metate fragments and 181 chert hammerstones in one mound of the Tzib Group in the periphery of Pacbitun has contributed to that much needed evidence (Figure 14.2). This discovery also offers an opportunity to highlight the survey methods that could lead to additional production area discoveries and examine aspects of this granite production sequence.

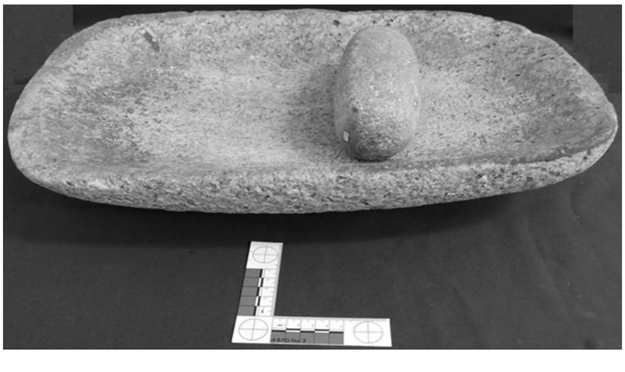

Figure 14.1. Common granite mano and metate pair found in Belize. Photographed by Sheldon Skaggs with permission by the Belize Institute of Archaeology from the unprovenanced collection of artefacts found in the Cayo District.

Geologic Sources of Granite in Belize

The bedrock of Belize primarily consists of sedimentary rocks like limestone, with a few plutons of granite poking up through the terrain and forming the Maya Mountains. The three plutons, which make up these mountains, are the Hummingbird Ridge (northeast), Cockscomb Basin (south), and Mountain Pine Ridge (northwest) as seen in Figure 14.3 (Dixon 1956). Macroscopically, the granite of Hummingbird Ridge and Cockscomb Basin plutons are most similar to each other, both consisting of mostly larger white or grey crystals of plagioclase feldspar and quartz, along with small black biotite crystals. Granites of the Mountain Pine Ridge, sources of which are only 5 kms south from Pacbitun's site core, are much less uniform, consisting of several different granite compositions (see chapter fifteen, this volume; Jackson *et al*. 1995). Macroscopically, the most common granite form consists of rock with large, pink potassium feldspar, grey quartz crystals, and small black biotite or clear muscovite crystals. Petrographic attempts at sourcing Maya groundstone tools from Belize began with Shipley and Graham's approach in 1987, followed by Abramiuk and Meurer's efforts on the southern Mountain Pine Ridge rocks in 2006. Most recently, a chemical analysis to source groundstone tools and Belize granites, some specifically from Pacbitun, was conducted using portable X-Ray Fluorescence or pXRF (see chapter fifteen, this volume; Tibbits 2015, 2016).

Tzib Group Site Description

The Tzib Group, identified in 2011, is situated in a pasture some 650 m to the northwest of Pacbitun's epicenter (Ward 2013). One mound, within a grouping of mounds, was designated by Ward as Mano Mound (due to the large number of broken manos, metates, and granite flakes laying on its surface). Additionally, Ward (2013) focused on a three-mound structure roughly 80 m downslope to the southwest of Mano Mound. These mounds, labelled A-D in Figure 14.4, are located just west of survey transects conducted in 1987 from the centre of Pacbitun (Sunahara 1995). We have expanded the scope of the Tzib Group to also include previously surveyed mounds, numbered 269-271. These additional mounds make the Tzib Group

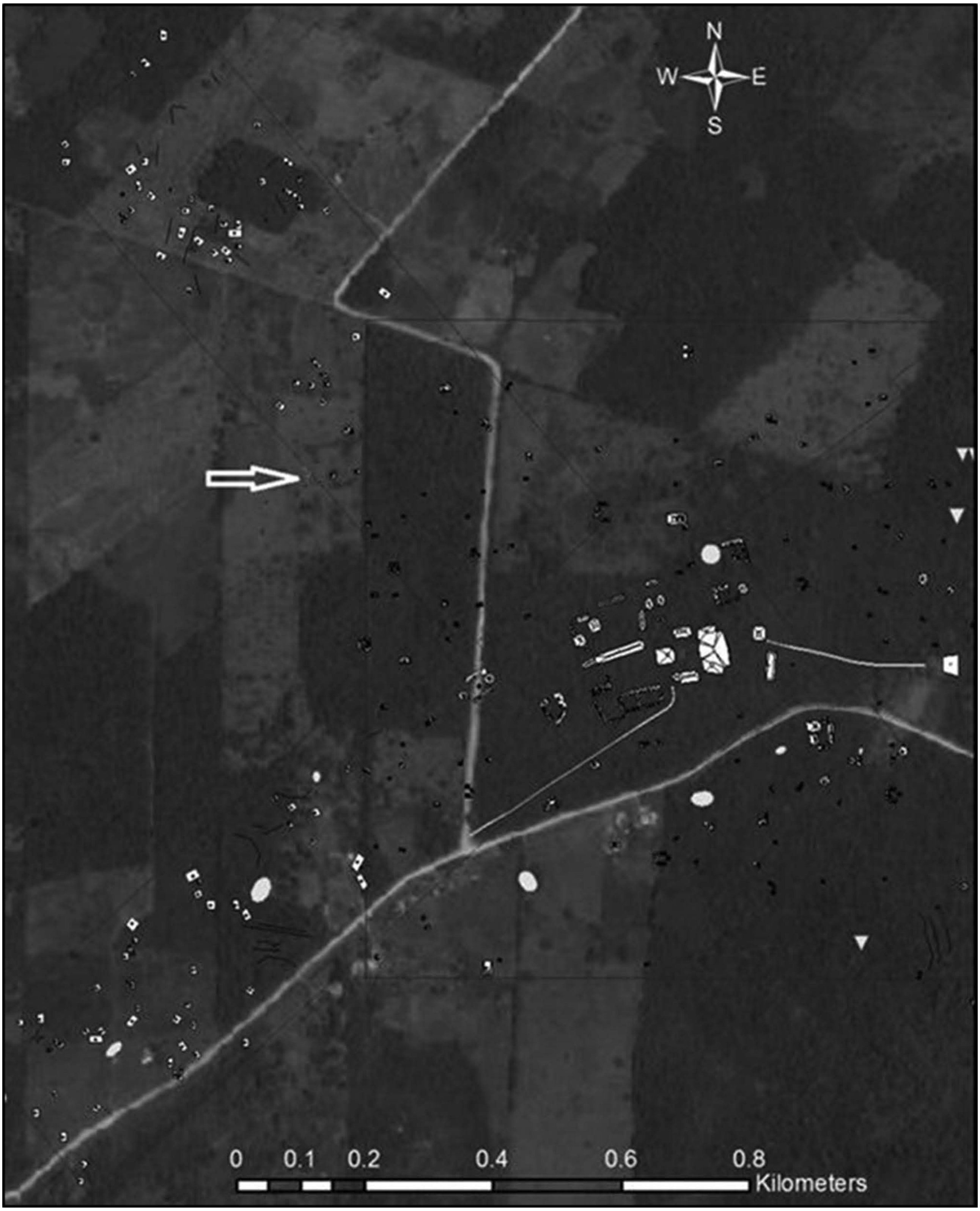

Figure 14.2. Overlay of Pacbitun site features on satellite imagery of the area. White arrow shows the location of Tzib Group to the northwest of the epicentre of the site. Structures and housemounds which were mapped by Sunahara's surveys (1995) are show as wireframe buildings. Also shown are terraces (black lines) and water sources (white circles).

roughly 165 m northwest to southeast and 150 m east to west. Mano Mound (A in Figure 14.4) was approximately 5 m north to south by 8 m east to west and stood 0.75 m high. It may have been ploughed, reducing the height from what it would have been in the past (Ward 2013). The northern mound of the three structure plazuela group (B in Figure 14.4) stood about 1.5 m tall, while the eastern and western mounds (C and D in Figure 14.4) only measured around 1 m tall. Mounds 268-271 were all less than 1 m in height.

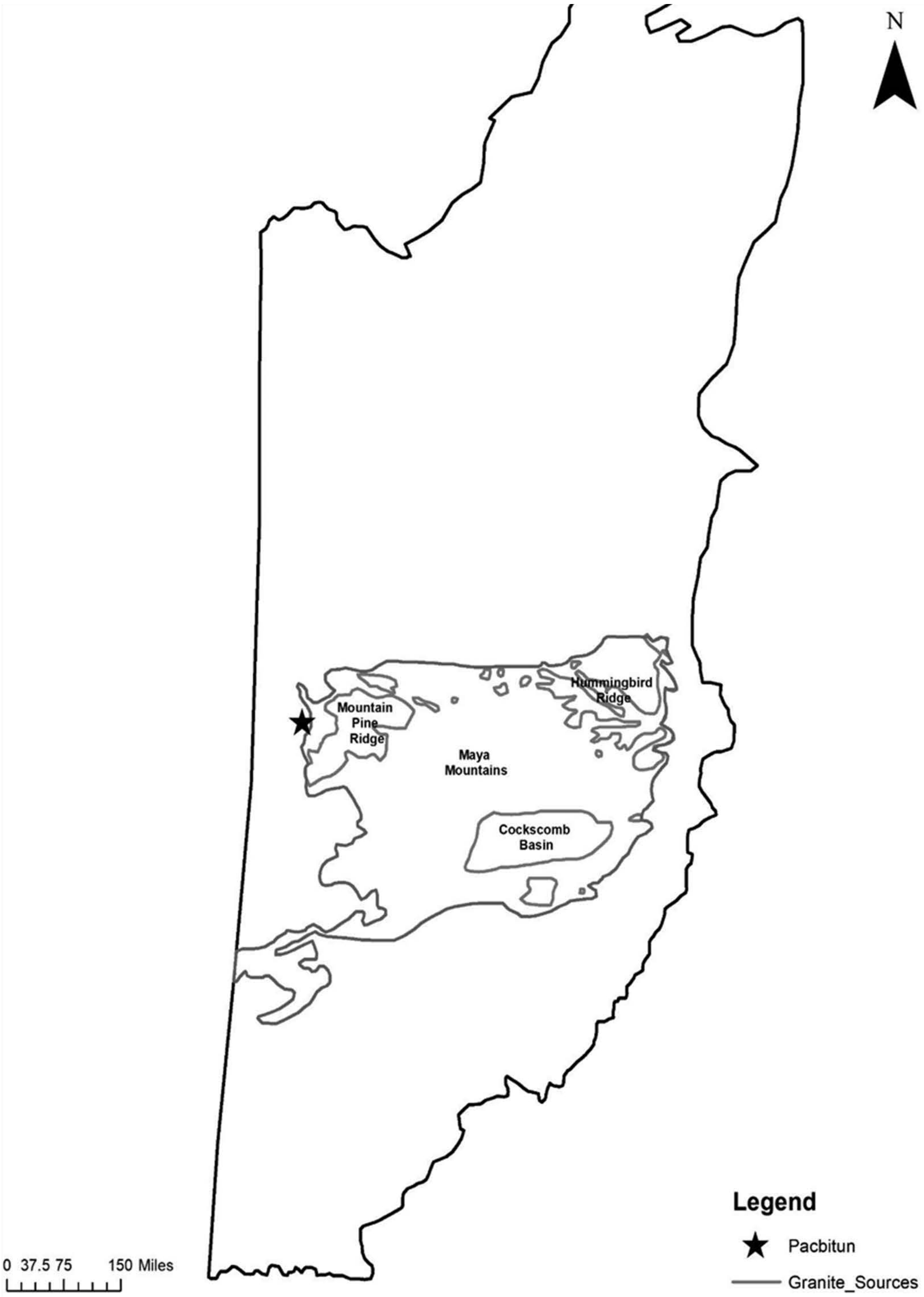

Figure 14.3. Location of Pacbitun (star) compared to the three major granite sources and the Maya Mountains in Belize.

A group of mounds roughly 150 m north of Mano Mound (272-281 in Figure 14.4) were also previously surveyed in 1987 and might possibly belong in the Tzib Group. However, only the 25 m long platform on which Mounds 273-275 were situated, Mound 281, and a slight rise in elevation at Mound 277 were still visible in 2016. The entire cluster of mounds measures 125 m northeast to southwest and 75 m northwest to southeast. Test pits around this area along with small excavations on Mounds 274 and 279 (Sunahara 1995) suggests this is probably a separate area from the Tzib Group, as explained below.

Tzib Group Excavations: 2012 to 2017

The feature known as the 'Mano Mound' was discovered in December 2011 by Patrick Severts and Drew Ward during a survey to relocate mounds originally identified by Sunahara in the 1990s (Ward 2013:31). The Tzib Group (Figure 14.4) was first discovered while defining the boundaries of the northwest transect from Sunahara's survey (Ward 2013:31). Found on the surface of a stand-alone mound, on property owned by Carlomagno Tzib, were a large quantity of what appeared to be mano and

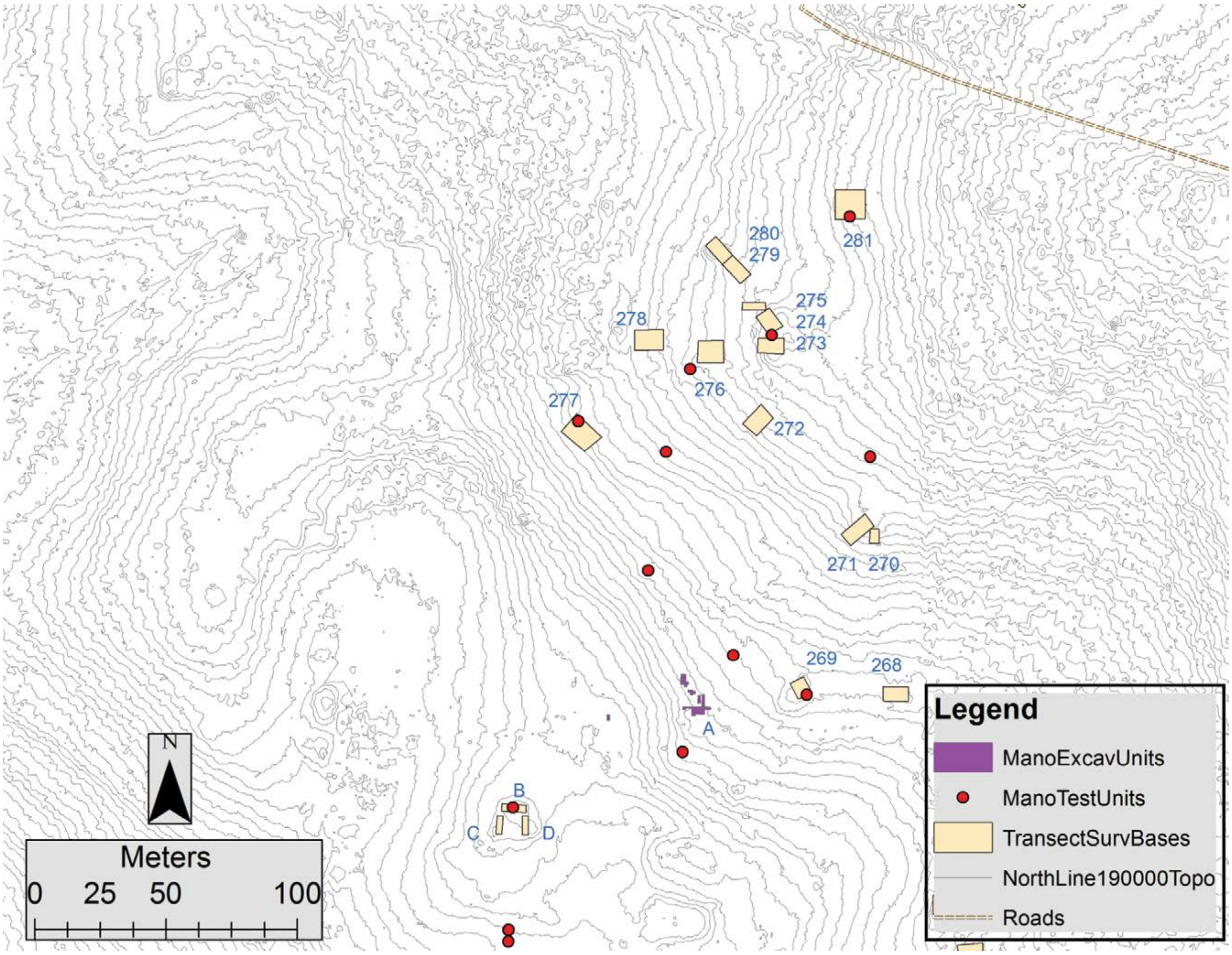

Figure 14.4. Area around the Tzib Group. Mounds with letters A (Mano Mound), B-D were surveyed and a few excavated by Drew Ward (2013). Mounds with numbers were surveyed and a few excavated by Sunahara (1995). Purple squares are units and red dots are test pit locations excavated by Skaggs *et al.* (2016).

metate fragments at various stages of production as well as residual flakes created from a lithic reduction process (Ward 2013:32).

Excavation of Mano Mound began during the 2012 field season (Ward 2013:34), with Unit 1A, positioned on the zenith of the mound (Figure 14.5). The unit, as a whole, was excavated in three distinct levels. The first level consisted of a large amount of granite debitage. The second level was mainly composed of debris in the form of sand, a by-product of the production of manos and metates. The third level consisted of yellowish-brown clay and contained a higher density of artefacts than Level 2 (Ward 2013:34-38). Level 3 appeared to be the last cultural level and mostly ceramic and lithic remains in 'relatively high densities' (Ward 2013:39) were found. Before excavating Level 2, Ward (2013:35) noted the exposure of the southwestern portion of Unit 1A revealed a cluster of 16 mano and metate preforms that rested on top of Level 2 (Figure 14.6). The presence of the cluster convinced him to open two extensions on the southwestern corner of his unit that were 0.25 m x 1.5 m each (Ward 2013:35).

The field seasons of 2014 and 2015 confirmed the presence of these three levels identified by Ward. Several features, including the thick, sandy layer running throughout the previous summit units of mano mound, were absent in a unit 12 m down slope (Unit 2), suggesting the sand was culturally deposited, rather than from flooding (Balinger *et al*. 2015).

In the northeastern corner of Unit 1B was a higher concentration of larger granite flakes found within a darker soil matrix. This area, designated as Lot 1, produced most of the mano, metate, and large granite flakes found in later excavations (Skaggs *et al*. 2016a).

The Lot 1 material is in direct contact with surrounding topsoil, and most likely encompasses the entirety of Mano Mound. This transition from topsoil to Lot 1 was seen as a pile of rocks and mano fragments in Unit 1I and Unit 1E. This is visible in the eastern profile of units 1C to 1D as well (Figure 14.7). The boundary of Mano Mound can be mapped using the extent of Lot 1 material, and it appears that the mound feature is approximately 7 m east to west by 5 m north to south (Skaggs *et al*. 2016a). In order to

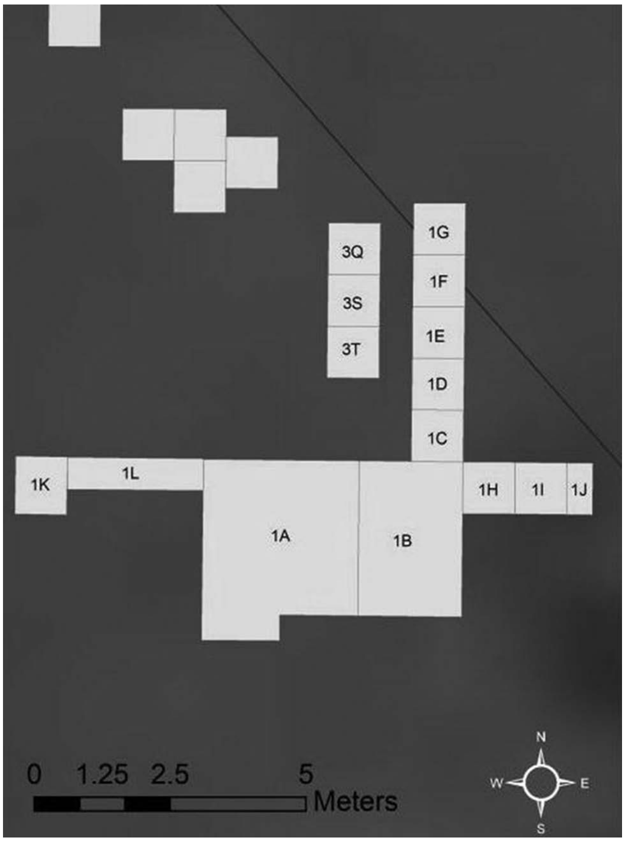

Figure 14.5. The Tzib Group excavations on Mano Mound by Ward (Unit 1A), and Skaggs (Unit 1B to 1L and 3Q, 3S, 3T). Unit 2 was excavated down slope (off map) about 12 m west of Unit 3Q.

investigate other mound features nearby, we placed a total of 16 test units in various mounds around the Tzib Group area (Figure 14.4). One was placed in 2012, 12 in 2015, and three much further south (Figure 14.8A) in 2017 (Cartagena 2018). Four test units (Test Units 3, 4, 11, and 12 in Figure 14.8B) were placed to explore three different mounds and all were discovered to have the same granite and sand layers found during the excavations of Mano Mound (Figure 14.9A). Test Unit 12 was placed at the centre of the mound due to an increase of sandy soils found within a previous test, Test Unit 11. Test Unit 4 is located on the southern edge of a ploughed field where evidence of granite flakes, a metate preform, mano preforms, and hammerstones were very abundant over a 20 m area, suggesting that a mound had been destroyed by agricultural activity (Figure 14.9B). This area corresponds with Mound 276 (Figure 14.4). Excavation at Test Unit 3 noted the presence of slightly sandier soil, but unlike at Test Unit 11, it did not receive additional testing (Skaggs *et al*. 2016a). One of the three southernmost test units also discovered sandier soil that appears, macroscopically, to be granite sand, but petrographic analysis has not yet been performed (Cartagena 2018).

After several years of extensive investigations of Mano Mound, enough ceramic data has been recovered to accurately date the mound feature. Interestingly, of the 2,230 ceramic sherds recovered, a large majority were found within Lot 1 (granite and dark soil matrix) thought to encompass the mound. All the ceramic sherds that could

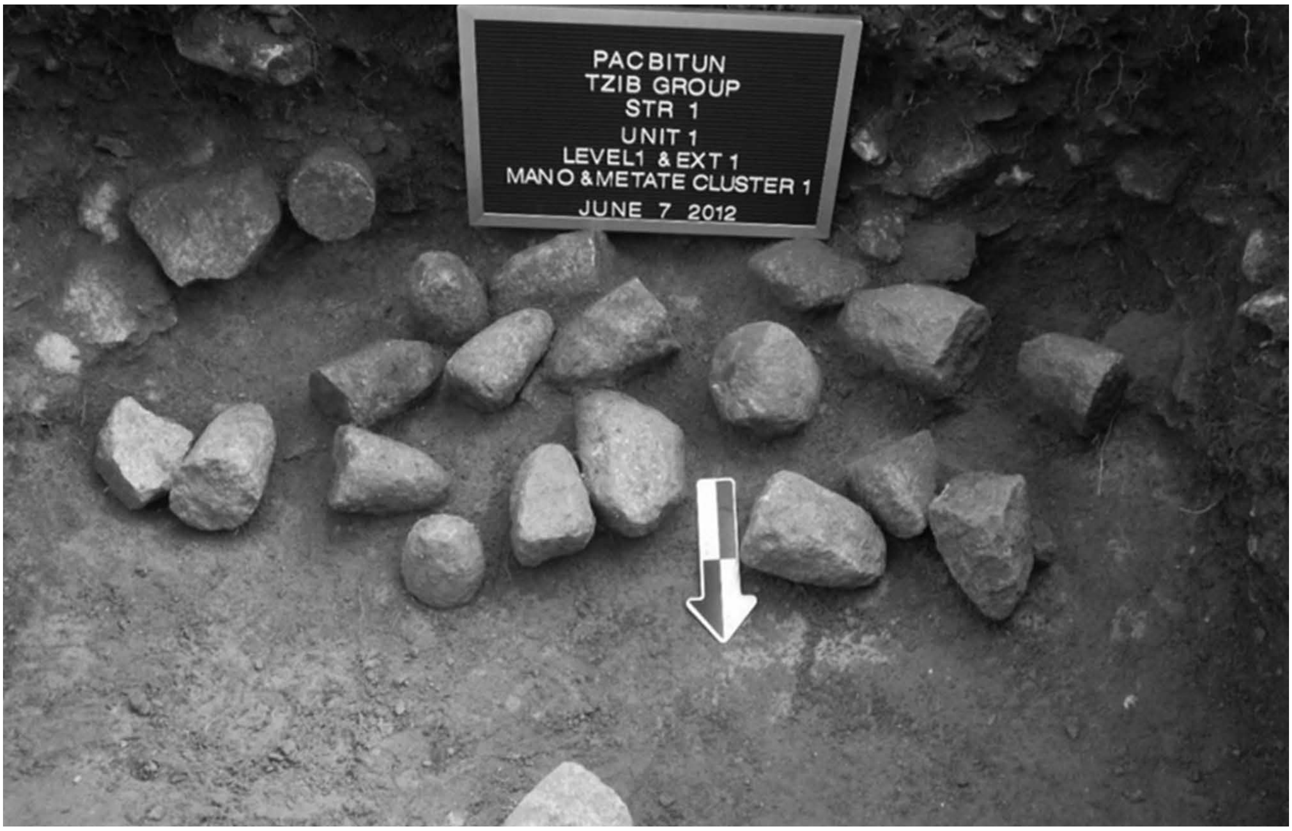

Figure 14.6. Photograph, courtesy of Drew Ward, showing the southwestern portion of Unit 1A where a cluster of 16 mano and metate preforms are resting on top of Level 2.

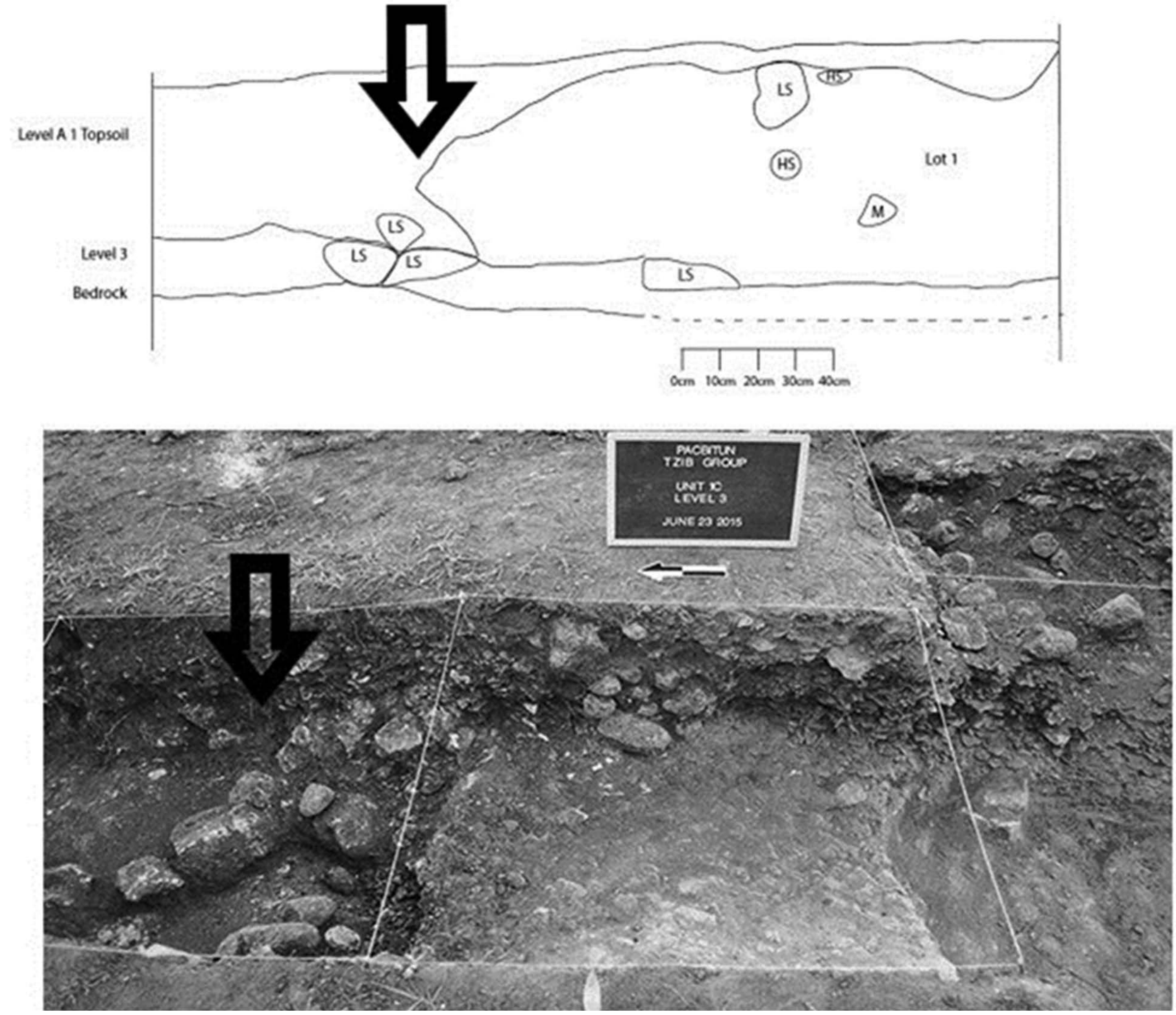

Figure 14.7. Eastern profile of Units 1C to 1D. Lot 1 material, which contained most of the large granite flakes along with mano and metate fragments, is seen in contact with Level 1 topsoil on the north side (left) of the profile marked with black arrows in both profile and photograph. To the right is Unit 1B which contained the Level 2 granite sand. LS stands for limestone, M for mano fragment, HS for hammer stone. Level 3 is the dark, ceramic rich layer of soil just above bedrock.

be identified were classified as belonging to the Spanish Lookout Complex, with an occasional Tiger Run Complex or earlier sherd, as defined by Gifford (1976). The ceramic analysis thus suggests the feature corresponds to Pacbitun's Late Classic period (AD 550-800). Sherds found in these units primarily consisted of Dolphin Head Red, Cayo Unslipped, Alexanders Unslipped, Belize Red, and Garbutt Creek types (Gifford 1976). Unfortunately, no stratigraphically isolated carbon samples were recovered, precluding the possibility of obtaining radiocarbon dates (Skaggs *et al*. 2016a).

Ethnohistorical Production of Manos and Metates in Mesoamerica

The general lack of archaeological evidence for ancient Mesoamerican mano and metate production in the archaeological record has led to the assumption that the organisation of production in the past was similar to the ethnographic observations of production sequences, acquisition, transportation, distribution of production debris and tools, and the stages of production of these objects. An examination of the ethnographic literature on groundstone production within Mesoamerica helps to contextualise the granite materials found at Pacbitun. Comparisons between the ethnohistorical model and the data derived from the Tzib Group of Pacbitun reveals ancient Maya production methods. For the purposes of this chapter, a very brief overview of the ethnohistorical studies available on production is appropriate.

Modern production of groundstone tools, specifically manos and metates, is accomplished in two distinct activities and at spatially distinct locations. The two basic activities can be separated into three separate production phases (Jaime-Riveron 2016:134-137, 142-143, 150; Ward 2013:13-15). In many of the ethnohistorical observations, the three production phases include a rough removal of a suitable stone or block from a quarry or other site, a reduction phase in the same location, and a finishing phase,

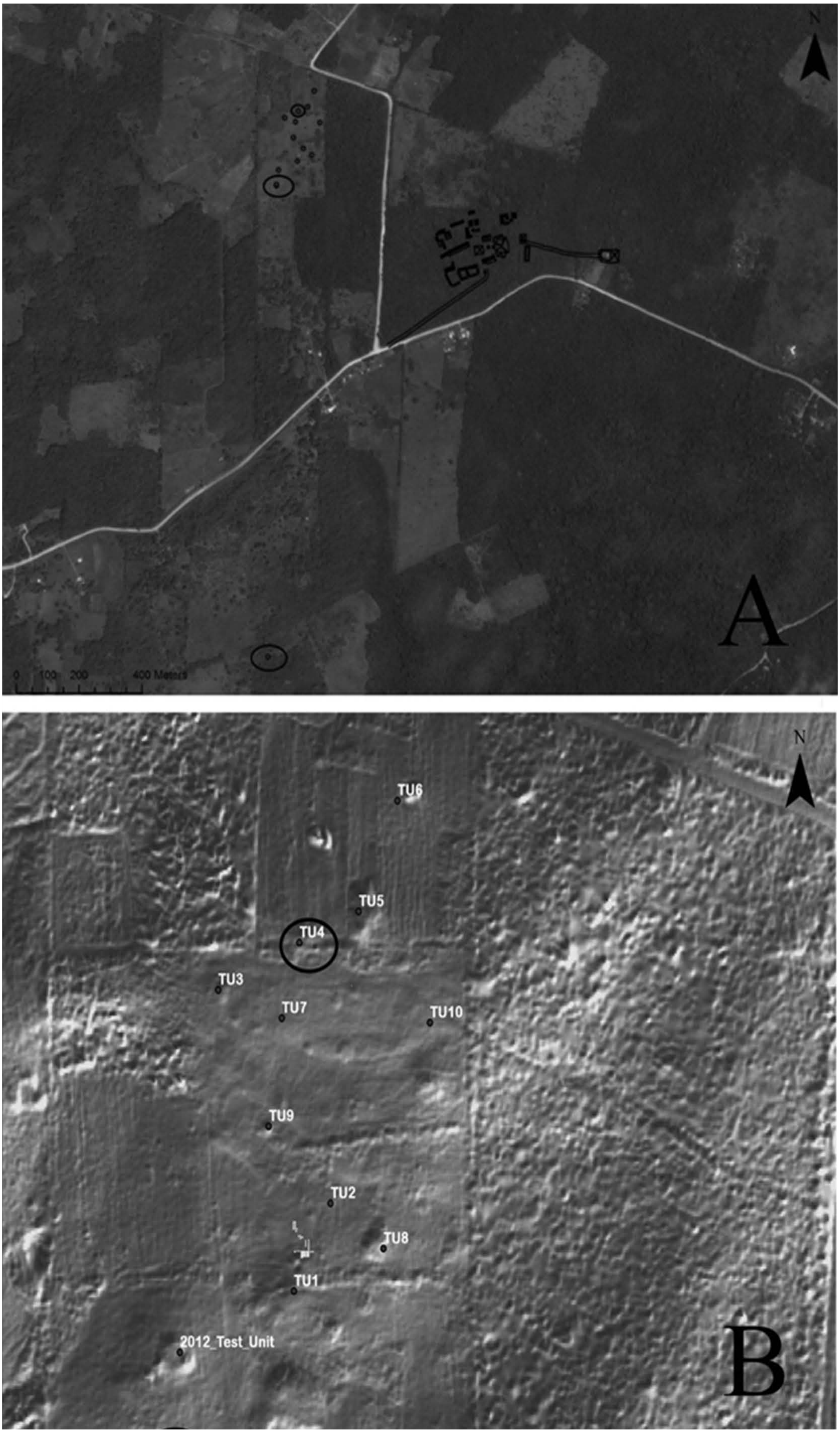

Figure 14.8. A) The location of three test units south (circled in black at south of map) compared to the test units with granite sand (circled in black at north of map) around the Tzib group and the location of Pacbitun site core. B) Shows zoomed in area with the Test Units (black circle around one with granite sand) compared to Tzib group and excavation units.

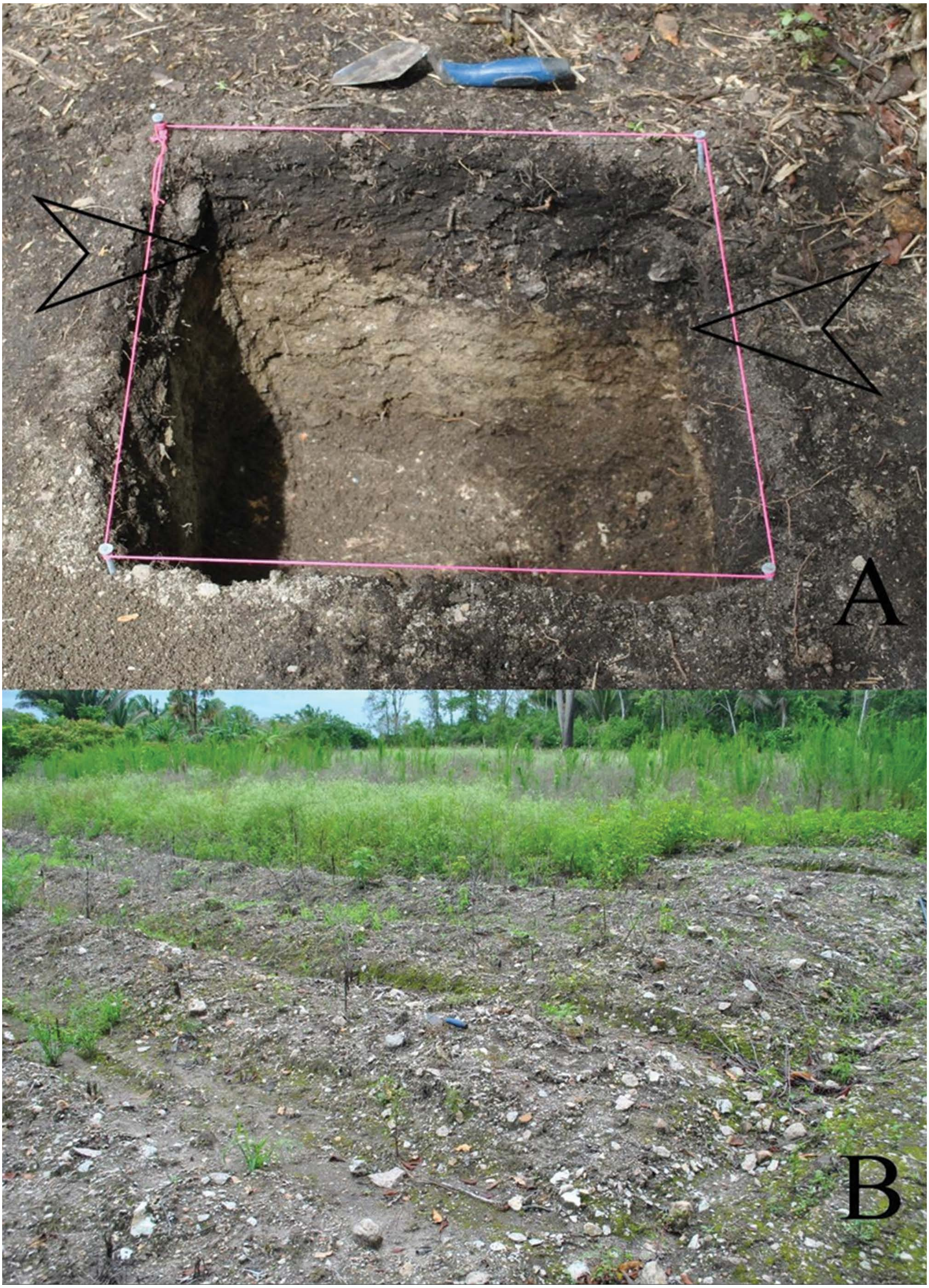

Figure 14.9. A) Photograph of the east wall of Test Unit 4 (trowel pointing north) with the boundary between topsoil and the granite sand layer marked with arrows. B) Photograph by Sheldon Skaggs, looking northeast (trowel pointing north) at the ploughed field that likely was once a granite production mound based on sand layer found in Test Unit 4, which is off camera to the right, just past the edge of field.

which often occurs at a distant home workshop location. Garcia Chavez (2002:138), as translated by Jaime-Riveron (2016), notes that in Chimalhuacán, Mexico, the reduction of blocks does not happen at the quarry site, but at the home workshop instead, unlike the process described by Cook (1982), Hayden (1987), and Searcy (2011). Jaime-Riveron (2016:143) suggests that the abundance of cheap transportation (modern cars) is the reason for the difference.

The first step in the ethnohistorical production sequence is the acquisition of raw materials. This involves the removal and rough shaping of a block of stone using, in some cases, explosives, steel wedges, sledge hammers and steel pinch bars (Cook 1982:185). The second step involves the completion of the task of refining the rough preform which includes the 'flattening [of the] grinding surface, straightening the edges and sculpting out the feet of the metate' (Hayden 1987:38-39). The final step involves the finishing of the tool into a useable final product by the process of smoothing. Hayden's (1987:41) description of the process includes the utilisation of 'smaller, specialized (sic) smoothing stones to abrade the surface of the metate in a swiping motion' and the use of a mano to grind an even smoother surface.

The ancient Maya at Pacbitun would not have been able to employ the modern techniques of using explosives or metal pry-bars, but would have utilised stone wedges and picks. One possible process the metateros of the Pacbitun region may have employed is the fashioning of rough pre-forms. Modern metateros reduce the weight of materials to be transported, as described in Hayden's account, following the selection of a suitable stone; a 'large stone was elevated onto a smaller stone that acted as an anvil. A groove was cut using smaller stone pics that would end up being several centimeters (sic) deep. The large basalt block would then be split by striking it on top with another boulder' (Hayden 1987:24). Generally, the first production stage would result in the loss of about 50 to 60 percent of the mass to form a blank for transport (Hayden 1979:28). Another important facet of production in the modern era is the locality of manufacture of groundstone tools. In contrast to results that Hayden found, Jaime-Riveron (2016:157) observed that there are two communities in the Puebla region of Central Mexico where production is located in 'barrios that are specialized (sic) in making stone grinding tools... families live in [these] barrios and specialize (sic) in manufacturing a component of grinding activities (for example they make only metates or manos).'

We suggest that the production site at Pacbitun is possibly the location to which quarried blocks would have been transported for the second and third phases of mano and metate production. The shaping and finishing phases may have utilised bone and stone tools such as picks, scrapers, scratchers, abraders and polishers as described by Robles-Garcia (1994) and quoted in Jaime-Riveron (2016:149). While archaeological evidence shows that the Maya did not organise into barrios, the Tzib Group of Pacbitun appears to be located within an area of concentrated stone tool production, as evidenced by the discovery of other debitage and granite sand mounds in close proximity to Mano Mound.

The Assemblage

Preforms

In total, 78 mano fragments were found during mound excavations. The mano fragments generally consisted of part of the barrel of the mano and one tapered end. Only one example was found that was just the barrel. Macroscopic examination of the fragments shows no grinding polish or wear on the barrels. Indeed, many are lopsided in shape, with clear evidence that circular reduction of the fragment was abandoned before working completely around the barrel of the mano. This is the reason these are classified as preforms. Most were broken perpendicular to the axis of the mano (Figure 14.10A); however, ten were split into halves or quarters parallel to the axis of the mano (Figure 14.10B). These split samples were not used in the

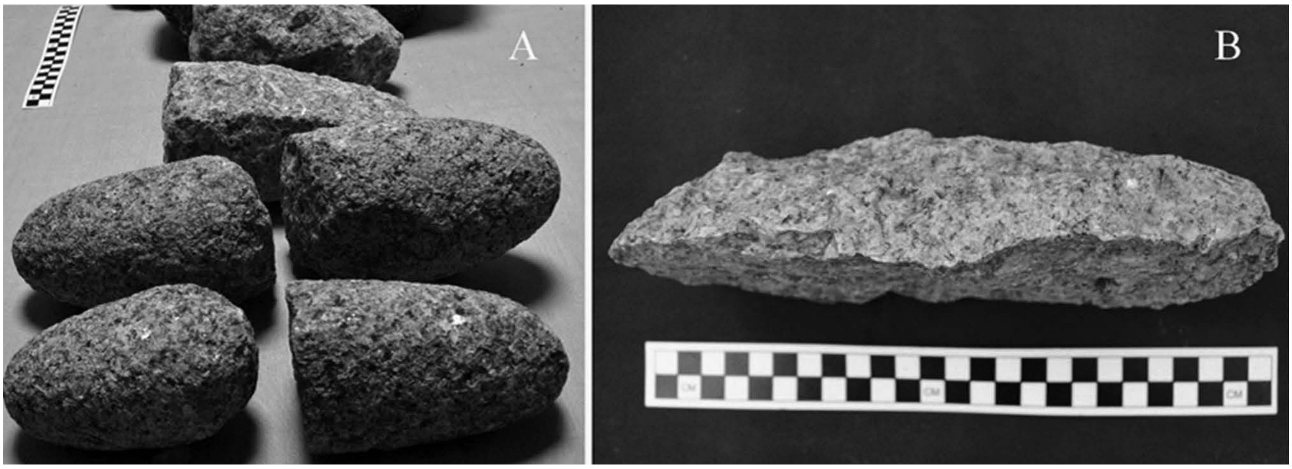

Figure 14.10. A) Typical broken ends of manos found during excavations. B) A small percentage of manos broke in half or quarters along the axis of the mano like the example shown here.

dimensional analysis. The range of lengths from the end of the mano to the break point ranged from 5 cm to 15.5 cm, with a median length of 8 cm. The diameter of the barrel was measurable in 63 samples, and ranged from 6 cm to 12 cm, with an average of 10 cm. The remaining fragments were too short to accurately measure the diameter. No mano fragments appeared to mend together, however the most conservative measure of the minimum number of whole manos represented in the mound debris is 34. Mano fragment weights ranged from 0.6 kg to 3.25 kg, with a median weight of 1.78 kg.

Metate preforms were more difficult to determine since the size and shape of each is approximately the same as a granite flake. Evidence of a flat grinding surface or a trough/polished channel was the factor used to differentiate a flake from a metate fragment. Furthermore, it is difficult to macroscopically differentiate between preform fragments and metate fragments displaying a partial trough. Only one example found was clearly a preform, or blank, with a bit of rounding at the base. This one block of granite was found near Test Unit 4, and measures 31 cm by 19 cm by 15 cm. Total weight of the block was 17.51 kg (Figure 4.11).

There were an additional 66 granite fragments and one andesite metate fragment excavated. The fragments ranged in size, with a median width of 6 cm and length of 12.5 cm. Weight of the fragments ranged from 0.1 kg to over 5 kg, with a median of 0.73 kg. As before, none of the fragments appeared to mend. The conversion from 66 fragments to whole preforms, using 17 kg as the weight of one individual preform, the minimum number of whole metate preforms represented in the mound is five, including the one recovered near Test Unit 4.

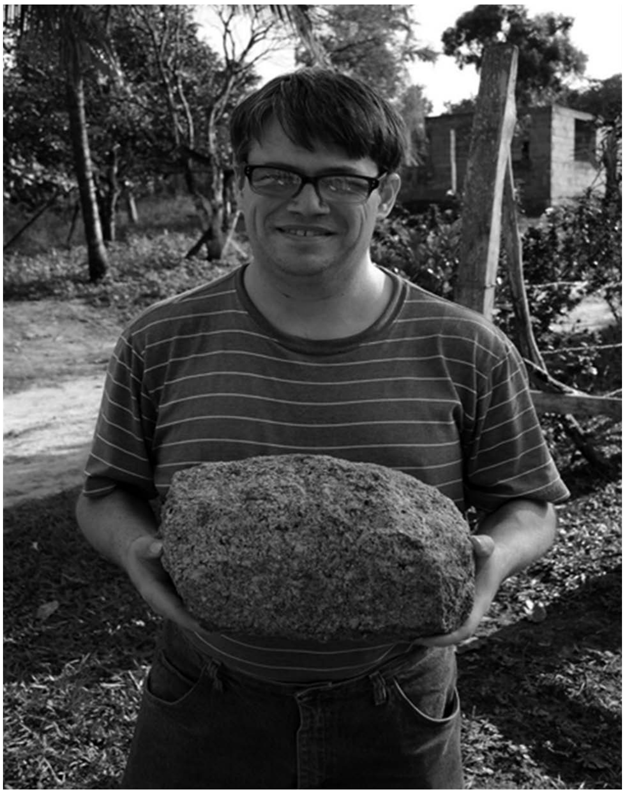

Figure 14.11. Example of a metate preform (with one flat side and one side rounded like a turtle shell form metate) weighing 17.51 kg. Photo courtesy of Terry Powis.

Production Tools

No picks (hammerstones facetted/tapered to a point on one or both ends) or organic tools like bone or antler were found during the Mano Mound excavations. However, the debris of the mound contained 134 spherical chert nodules, with little evidence of flaking, and four granite balls. The chert quality was exceptionally poor, with numerous cavities and inclusions throughout each nodule. Based on the size of the spherical shape, these likely served as hammerstones or abraders. Sizes ranged from 6 cm in diameter to 13 cm, with a medial of 9 cm. The weights ranged from 0.75 kg to 1.78 kg. Ten of the hammerstones were broken completely in half. It is likely, given the size and shape of these nodules, that the use was as percussion or pecking stones. Microscopic use wear analysis of the cortex of these artefacts has not been performed, but future research utilising this method of investigation might provide a more definitive functional use of these tools.

Debitage: Roughing Flakes, Chert Flakes, and Granite Sand

Excavated and collected debitage from all three seasons were weighed to determine the amount of material recovered. The granite flakes from only units directly over Mano Mound weighed in at 640.5 kg, and granite shatter, similarly constrained, weighed 839.6 kg. Based on Cook (1982), Hayden (1987), and Searcy's (2011) ethnographic accounts of modern metateros, the presence of a striking platform and bulb of percussion served as the criteria to distinguish granite flakes from shatter. Additionally, detailed granite flake and shatter counts were collected, with a total of 3,813 flakes and 23,469 pieces of shatter were counted (Table 14.1).

Chert flakes, the majority of very poor quality chert, were also recovered from Mano Mound and classified into primary, secondary, and tertiary flakes (Table 14.2). The 2015 excavation season, when excavations were focused in the Level 2 sandy layer, produced the majority of the chert material. It was noted during that season that the number of primary chert flakes was almost twice the other categories combined. In all three seasons, in those units directly over Mano Mound, a total of 193.34 kg of primary flakes, 99.0 kg of secondary flakes, and 50.91 kg of tertiary flakes, were excavated and collected (Table 14.2). In total, about 2,500 flakes were excavated from the Mano Mound investigation (Table 14.2).

The largest category of debitage was the granite sand layer that makes up Level 2. Since this layer averaged 75 cm thick across the entire mound, the volume of sand is approximately 14 cubic metres. At 1,500 kg/m^3, the weight

Table 14.1. Measurements taken of granite flakes and shatter of Tzib group units and levels. NR stands for Not Reported.

Unit	Level	Flakes (kg)	# Flakes	Range cm	Shatter (kg)	# Shatter	Range cm	Total wgt kg
1A	All	225.5	NR	NR	288.51	NR	NR	514.01
1B	All	59.63	746	NR	185.27	8775	NR	244.9
1C	1	17.72	145	16.0 -3.0	29.83	1434	8.0 - 2.5	47.55
1C	2	12.5	153	16.0 - 5.5	13.6	810	7.0 - 2.0	26.1
1C	2A Lot 1	30.93	130	19.0 - 6.0	45.33	738	8.5 - 2.0	76.26
1C	3	9.41	82	15.0 - 5.5	17.67	587	9.0 - 1.0	27.08
1C	3 sand	3.78	23	13.5 - 4.0	2.61	92	8.5 - 2.0	6.39
1D	1	1.71	13	13.0 - 6.0	11.92	915	7.5 -2.0	13.63
1D	2	9.87	18	18.0 - 14.0	10.31	144	11.0 - 4.0	20.18
1D	2 Lot 1	16.67	102	14.5 - 6.0	4.69	192	10.0 - 4.0	21.36
1E	1	22.01	165	15.0 - 5.5	13.04	245	11.0 - 2.5	35.05
1E	2	2.03	18	12.0 - 5.0	2.45	34	7.0 - 2.0	4.48
1F	1	0.18	4	6.0 - 3.0	0.16	13	4.0 - 0.2	0.34
1G	1	0.13	3	7.0 - 4.0	0.24	35	5.0 - 2.0	0.37
1G	3	1.6	18	9.0 - 3.0	3.21	98	7.0 -1.0	4.81
1H	1	16.21	190	12.0 - 3.0	11.24	400	10.0 - 4.0	27.45
1H	2	13.99	75	13.5 - 7.0	7.5	220	8.0 - 3.0	21.49
1H	2 Lot 1	20.14	155	15.5 - 5.0	19.74	730	9.0 -2.0	39.88
1I	1	5.06	58	15.0 -5.0	13.6	878	6.0 - 1.0	18.66
1I	2	5.33	32	16.0 - 5.0	2.44	82	8.0 - 2.5	7.77
1I	2 Lot 1	7.53	34	15.0 -6.0	6.83	105	9.0 - 1.5	14.36
1J	1	2.05	46	11.5 - 5.5	10.05	190	7.0 - 2.5	12.1
1K	1	52.45	440	20.0 - 5.0	46.68	938	13.5 -2.0	99.13
1K	2	31.31	235	18.0 - 4.5	25.34	988	11.0 -3.0	56.65
1L	1	5.38	36	15.0 - 5.0	0.91	38	7.0 - 2.0	6.29
1L	2	3.49	30	10.0 - 3.5	1.37	93	6.0 - 1.0	4.86
1L	3	9.88	98	15.5 - 5.0	6.86	256	10.5 - 1.0	16.74
1L	4	33.09	271	18.0 - 5.0	31.35	1149	9.5 - 2.0	64.44
3A	1	0.08	6	4.0 - 3.5	0.01	6	4.0 - 2.0	0.09
3C	1	0.11	3	7.0 - 4.0	0.17	27	4-.0 - 0.5	0.28
3D	1	0.01	2	6.0 - 4.0	0.01	3	2.5 - 2.0	0.02
3D	2	12.53	70	14.5 - 6.0	7.75	306	8.0 - 1.0	20.28
3E	1	0	0	0 - 0	0.01	10	3.0 - 0.5	0.01
3E	2	0.01	2	4.5 - 4.0	0.01	4	3.0 - 2.0	0.02
3F	1	0.52	15	11.0 - 4.0	1.17	204	6.0 - 3.0	1.69
3G	1	0.09	5	5.0 - 3.0	0.09	17	4.0 - 2.0	0.18
3L	1	0.35	20	8.0 - 5.0	0.13	6	5.0 - 2.0	0.48
3P	1	0.52	15	11.0 - 4.0	1.17	204	6.0 - 3.0	1.69
3R	1	1.13	13	10.0 - 5.0	1.68	167	5.0 -2.0	2.81
3S	1	6.51	71	10.0 - 4.5	14.01	1016	7.0 -2.0	20.52
3T	1	7.85	101	15.0 - 4.5	7.26	393	7.0 - 2.0	15.11
3T	2	6.54	51	15.0 - 5.5	5.55	65	7.5 - 2.5	12.09
TU1	1	0.06	2	5.0 - 4.0	0.15	27	5.5 - 2.0	0.21

TU1	2	0	0	0 - 0	0.14	23	5.0 - 1.0	0.14
TU2	2	7.88	81	12.5 -10.0	3.84	164	7.0 - 2.5	11.72
TU3	1	0.08	2	6.0 -6.0	0.49	53	4.4 - 2.0	0.57
TU3	2	0	0	0 - 0	0	0	0 - 0	0
TU4	1	1	13	12.0 - 4.0	2.85	219	6.0 - 2.0	3.85
TU4	2	0.29	5	7.5 - 4.5	2.39	180	5.0 - 2.0	2.68
TU6	1	0.23	3	8.0 - 6.0	0.2	45	4.0 - 1.5	0.43
TU6	2	0	0	0 - 0	0.05	1	3.0 - 3.0	0.05
TU8	1	0	0	0-0	0.11	3	8.0 - 3.0	0.11
TU9	1	0.41	2	13.0 - 8.0	0.9	6	5.0 - 5.0	1.31
TU10	1	0.01	1	4.5 - 4.5	0.01	7	4.0 - 1.5	0.02
TU11	3	0.13	4	5.0 - 4.0	0.12	11	3.5 - 1.0	0.25
TU12	1	0.41	6	16.0 - 6.5	1.41	123	6.5 - 6.0	1.82
Totals								1530.76

Table 14.2. Measurements taken of chert flakes (primary, secondary, and tertiary) Tzib group units and levels. NR stands for Not Reported.

Unit	Primary (kg)	#	Range cm	Secondary (kg)	#	Range cm	Tertiary (kg)	#	Range cm	Total
1A	NR	132	NR	NR	571	NR	NR	316	NR	0
1B	52.27	NR	NR	28.02	NR	NR	41	NR	NR	98.56
1C	4.23	95	10.5 -4 .0	2.4	95	9.0 -2.0	0.51	156	8.5 - 2.0	7.14
1C	2.55	48	11.5 - 2.5	3.34	112	7.0 - 3.0	0.32	27	4.0 - 2.5	6.21
1C	9.45	127	15.0 - 4.0	3.65	72	8.0 - 3.0	0.88	35	7.0 -2.0	13.98
1C	3.49	53	12.0 -3.0	2.67	67	10.0 -3.0	0.98	34	7.0 - 2.0	7.14
1C	0.43	11	8.0 - 3.0	0.7	14	7.0 - 4.0	0.27	10	7.0 -3.0	1.4
1D	3.69	66	10.0 - 4.0	1.38	76	8.0 - 2.0	1.15	70	8.0 - 2.0	6.22
1D	1.11	16	10.5 - 4.0	1.21	18	8.0 - 4.0	0.05	6	4.5 - 3.0	2.37
1D	3.72	50	16.0 - 6.0	1.15	17	11.0 - 4.0	0.28	7	7.5 - 3.5	5.15
1E	2.17	32	10.0 - 3.5	0.97	17	7.0 -5.0	0.73	40	8.5 - 3.5	3.87
1E	0.66	4	7.5 - 5.5	0.05	3	7.5 - 5.5	0.01	2	6.5 - 4.0	0.72
1F	0.01	5	9.0 - 3.0	0	0	0 - 0	0.01	1	5.0 - 5.0	0.02
1G	0.26	25	5.0 - 1.5	0	0	0	0.15	11	5.0 -2.0	0.41
1G	0.59	16	9.0 -3.0	0.37	10	8.0 -3.0	0.06	2	5.0 -4.0	1.02
1H	3.99	58	9.5 - 4.0	3.38	56	9.0 - 3.0	1.63	81	10.0 - 3.0	9
1H	3.53	40	8.0 - 3.0	1.42	23	11.5 - 4.0	0.9	23	4.0 - 3.5	5.85
1H	5.96	102	9.0 - 2.0	2.81	72	10.0 -2.5	1	87	8.0 -2.0	9.77
1I	3.07	55	9.0 - 2.5	1.61	119	7.0 - 2.0	1.36	163	5.0 -1.0	6.04
1I	0.91	11	12.0 - 3.0	0.16	5	6.0 -3.0	0.11	4	6.0 - 4.0	1.18
1I	1.33	19	9.0 - 2.0	0.87	16	8.0 -3.0	0.14	6	9.0 -3.0	2.34
1J	0.09	4	7.0 - 3.5	0.18	3	8.0 - 5.5	0.05	3	6.5 - 3.0	0.32
1K	20.92	189	15.5 - 3.0	7.05	122	12.0 - 2.0	2.59	80	10.0 - 2.5	30.56
1K	10.43	136	14.0 - 3.5	5.22	126	11.0 - 2.5	1.83	84	11.0 - 2.0	17.48
1L	6.97	62	12.0 - 4.0	3.1	83	8.5 - 3.0	2.07	88	8.0 - 2.0	12.14
1L	1.04	23	8.0 - 3.0	0.72	29	10.0 - 2.5	0.51	17	8.0 - 1.0	2.27

1L	2.84	30	12.0 - 4.0	1.43	45	10.0 - 3.0	0.55	26	7.0 -3.0	4.82
1L	11.28	160	13.0 - 3.5	6.03	156	13.0 - 3.0	4.04	209	9.0 - 2.0	21.35
3A	0.01	2	3.0 - 1.5	0	0	0	0	0	0	0.01
3C	0	0	0	0	0	0	0	0	0	0
3D	0	0	0 - 0	0.05	2	5.5 - 5.0	0.01	2	4.0 - 2.5	0.06
3D	4.04	76	12.0 - 3.0	1.4	30	12.0 - 2.0	0.51	95	9.0 - 1.0	5.95
3E	0.05	2	5.0 - 4.0	0.03	2	5.0 - 4.0	0.01	1	1.0 - 1.0	0.09
3E	0	0	0	0	0	0	0	0	0	0
3F	0.75	24	10.0 - 4.0	0.3	12	7.0 - 3.5	0.59	57	10.5 -2.0	1.64
3G	0.01	1	3.0 -3.0	0.01	1	3.5 - 3.5	0.01	2	2.5 - 2.0	0.03
3L	0	0	0	0	0	0	0	0	0	0
3P	0.75	24	10.0 - 4.0	0.3	12	7.0 - 3.5	0.59	57	10.5 - 2.0	1.64
3R	0.56	21	8.0 - 4.0	0.12	13	5.5 - 3.0	0.27	25	7.0 - 2.0	0.95
3S	3.75	60	10.0 - 2.0	2.32	141	8.0 -2.0	1.46	110	9.0 - 2.0	7.53
3T	3.2	42	11.0 - 3.0	3.81	166	7.5 - 2.0	0.7	42	7.0 - 3.0	7.71
3T	3.53	55	13.5 - 3.0	1.31	21	9.0 - 4.0	1.13	31	9.5 - 3.0	5.97
TU1	0.08	14	5.0 - 4.0	0.05	8	5.5 - 2.0	0.04	4	1.0 - 1.0	0.17
TU1	0.12	7	7.0 - 1.5	0.03	2	4.5 - 2.5	0.04	7	3.5 - 1.5	0.19
TU2	1.01	22	9.0 - 6.5	0.53	18	6.5 - 4.0	2.3	12	6.0 - 4.0	3.84
TU3	0.45	13	5.0 - 3.0	0	0	0 - 0	0.11	30	4.0 - 1.5	0.56
TU3	0.04	3	3.0 - 3.5	0.04	1	3.4 - 3.4	0.04	3	2.5 - 1.5	0.12
TU4	0.81	16	10.0 - 2.0	0.45	30	7.0 - 2.0	0.15	45	6.0 - 2.0	1.41
TU4	0.84	17	8.0 - 1.2	0.52	15	6.0 - 1.5	0.59	61	5.5 - 1.5	1.95
TU6	0.1	6	5.0 - 3.5	0.09	5	5.0 - 1.5	0.11	5	8.0 - 1.5	0.3
TU6	0.08	1	5.0 - 5.0	0.05	1	4.0 - 4.0	0	0	0 - 0	0.13
TU8	0	0	0 - 0	0.09	2	5.0 - 3.0	0	0	0 - 0	0.09
TU9	0.12	2	11.0 - 7.0	0.4	2	6.5 - 6.0	0.1	2	5.0 - 3.5	0.62
TU10	0.01	1	4.0 - 4.0	0.22	5	5.0 - 4.0	0	0	0 - 0	0.23
TU11	0.21	2	7.5 - 2.5	0.21	5	7.5 - 5.5	0	0	0 - 0	0.42
TU12	0.39	8	18.5 - 5.0	0.14	11	5.5 - 4.0	0.72	25	10.0 - 9.0	1.25
Total										320.19

of granite crushed to produce the sand would have to be estimated at 21,000 kg.

Discussion: Implications of the Mano/Metate Production at Pacbitun

Most of the mano/metate fragments, hammerstones, and larger granite flakes were excavated from around the edges of the Mano Mound deposit (Balinger *et al*. 2015; Skaggs *et al*. 2016a; Ward 2013). The presence of these larger artefacts, found encircling the edge of the mound and the Layer 2 micro debitage sand, suggests that materials were either being piled up in this manner intentionally, or the material was being swept off the edges of a working surface, which accumulated to form an anthropogenic sediment comprised of micro debitage. Although no evidence of formal platform structures such as cut stone bases or post holes for protective superstructure were found, it is hard to imagine a natural process that would concentrate materials in this manner. The arrangement is similar to work platforms found near ancient stone quarries in southern California. Schneider (1996:304-305) states:

> Production took place on level work areas, which include platforms of accumulated production debris... of percussion flakes (ranging in size from about 1 cm to 50 cm), discarded and broken preforms of pestles and/or lower milling stones, used and broken cobble hammerstones... Percussion flakes are usually distributed with larger-sized flakes on the perimeter of the work area and smaller flakes filling the center (sic) of it.

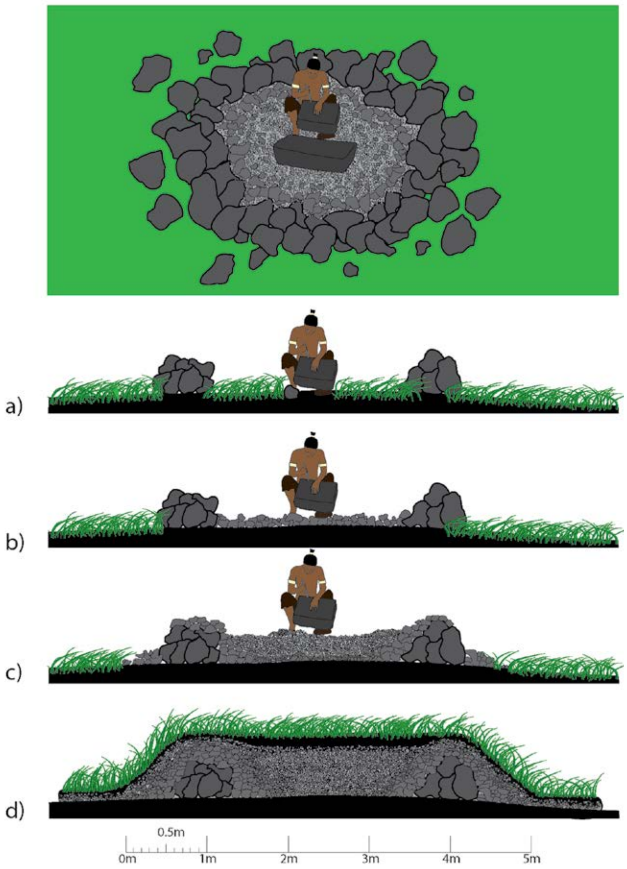

Figure 14.12. Illustration of how Mano Mound might have formed through use and the process of sweeping large flakes and preforms to the edges of the production area. The unlabelled top down view and profile view of step a) and b) begin the mound formation. In steps c) and d), the Lot 1 material excavated from Mano Mound corresponds to the left and right sides of the mound shown, with the sand micro debitage forming the centre (Illustrated by George J. Micheletti).

Mano Mound may be a small platform of this type, which was built up as a series of worked surfaces as shown in Figure 14.12. Schneider (1996) found examples of these types of features up to 10 m in size.

It is also interesting to compare ethnographic studies to the results at Mano Mound. Unlike in ethnographic accounts, the Mano Mound production area is not attached to a house or other structure. The closest mounds are 50 m away, and although these structures are Late Classic in date, shovel tests did not reveal any artefacts that would link them to Mano Mound (Skaggs *et al*. 2016a; Ward 2013). A few interesting points from Jaime-Riveron's (2016) observations seem to apply to Mano Mound. Similar to this study, the Mano Mound site appeared to be part of a community of metateros. As we have discussed, there are two confirmed areas within 150 m of Mano Mound that have also been found with the granite/sand layers. Another mound, 1.5 km away to the south, also had this granite/sand layer, suggesting that mano production was not just situated around Mano Mound in the northwest periphery (Figure 14.8). Mounds 274 and 279 were also tested by Sunahara (1995), and granite mano fragments were found in each mound (Figure 14.4). Mound 279 excavations revealed a burial with a mano included with the grave goods of the individual. This was in a ploughed field at the time of excavation so it is not entirely certain the mano was placed in the burial rather than just being moved there later by agricultural activities. Mound 274 is elevated above the ploughed field, and had numerous granite mano fragments. We believe the mounds around Test Unit 4 are also a mano and metate production area, separate from Mano Mound. Both mounds contained Spanish Lookout ceramics, although Mound 279 also had Barton Creek ceramics (Gifford 1976) mixed into the layers.

The presence of large granite flakes amongst granite sand suggests the production at Mano Mound is somewhere between the stages defined by Cook, Hayden, and Searcy. In fact, the 17.5 kg block found near Test Unit 4 should have been reduced in size at the quarry site according to the ethnohistorical accounts. Jaime-Riveron (2016:143) found that if transportation is easy, then blocks of the size found at Mano Mound are carried to the last stage of production instead of being reduced at the quarry. This suggests that in the Late Classic at Pacbitun transportation may have been abundant and cheap.

Although speculative, it is useful to try to determine a minimum number of metates and manos that would be required to create a feature like Mano Mound. If we assume a 35 kg block would make a metate and its associated pair of manos, with about 50% wastage (this being fairly conservative based on ethnohistorical accounts suggesting blank weighs are closer to the final product weight, since more finished products are estimated using lower percentages of waste), then the weight of the granite sand layer and granite debitage found at Mano Mound would account for a minimum of 1,285 sets. Added to this are the five metates and 36 manos we already estimated earlier. Thus, Mano Mound probably represents roughly 1,290 metate and 2,600 manos being crafted in 150 years. That works out to nine sets a year. With three other production areas likely, that puts the crafting we know about at 36 sets a year. This is not an unreasonable number for a community of 5,000-6,000 highly dependent on maize.

The archaeological evidence at Mano Mound provides a survey method that can be employed for finding other mano and metate production areas at sites in Mesoamerica. Questioning local landowners regarding the presence of thick sand deposits or very well drained soils on their land could help to locate these production mounds. Furthermore, small mounds near areas found with an abundance of mano fragments littering the nearby surface area should be investigated. Those mound features testing positive for a thick sandy layer should be sampled further, and the sand examined microscopically for the presence of granite minerals or fragments. It is only through discovery and detailed study of these mano mounds at multiple sites that archaeologists will gain a true understanding of the processes and volume of ancient Maya mano and metate crafting and trade.

Acknowledgements

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15

Geochemical Sourcing of Granite Artefacts

Tawny Tibbits

Investigating the production and exchange of stone tools is vital to understanding these activities in archaeological contexts (Adams 2002; Biskowski 2000; Costin 1991; Hayden 1987a; Peregrine 1991; Rice 2009; Wells 2006). Provenance studies are a necessary part of understanding how ancient peoples acquired raw materials, where (or if) they moved the raw material before production, and where the finished tools were distributed within the community as well as within the broader region.

One issue with many provenance investigations is the dependence on destructive chemical analyses. Widely used compositional analyses, such as lab-based X-ray fluorescence (XRF), petrography, neutron activation, and electron microprobe require either a small whole-rock sample, a powdered sample, or thin section preparation (Gill 1997). These are moderately to very destructive analyses, which is not ideal when working with archaeological artefacts.

New non-destructive techniques for assessing the chemical and mineralogical composition of artefacts are rapidly becoming more available to archaeologists; it is vital that methodologies are developed and evaluated to accurately obtain and interpret data using these techniques. Portable X-ray fluorescence (pXRF) has been in use for the past decade. Recent advances in the technology have made it more effective for archaeological sourcing studies as the calibration has become stronger and the suite of elements that can be analysed has expanded (e.g., Barbera *et al*. 2013; Craig *et al*. 2007; Forster and Grave 2013; Frahm 2012; Goodale *et al*. 2012; Nazaroff *et al*. 2010). Chemical data can be obtained on a large range of elements (generally magnesium-uranium) in the field or lab with no damage to the artefact.

Portable XRF operates under the same principles as laboratory-based XRF. An X-ray beam is used to excite the atoms in minerals present at or near the surface of an artefact. During excitation atoms energise electrons to higher energy orbitals. When the electron relaxes back into the lower energy level, it emits energy in the form of an X-ray. This energy is specific to each element present (Gill 1997). The intensity of the X-ray observed by the pXRF unit is proportional to the concentration of the element within the sample. This allows for an internal calculation of the weight percent for the elements present based on an internal calibration programme.

The benefits and applications of pXRF to provenance studies have been well demonstrated for fine-grained (aphanitic) or glassy rocks, such as basalt and obsidian (e.g., Biskowksi 1999; Frahm 2012, 2013; Frahm and Doonan 2013; Grave *et al*. 2012; Nazaroff *et al*. 2010; Williams-Thorpe *et al*. 1999). When examining homogeneous materials, it is possible to obtain a representative geochemical signature in a single-shot analysis. The ability to use pXRF has also been documented on relatively finer-grained phaneritic and porphyritic rocks (Greenough *et al*. 2004). Little work has been conducted on coarse-grained, more heterogeneous rock types, such as granite. This is due in large part to the difficulty of obtaining a representative whole rock analysis on a material with grain sizes similar to the beam size (diameter of 10 mm). This similarity has the potential to result in analysing only a few mineral grains per data point in proportions that may not be reflective of the representative geochemical signature. Therefore, a sampling method must be developed in order to generate an average geochemical signature when dealing with coarse-grained rocks.

This study uses outcrop samples collected from throughout the Maya Mountains to test the viability of pXRF as a whole rock analysis method for granite and seeks to determine provenance for granite materials recovered at the site of Pacbitun. A comparison of XRF analyses using destructive (lab-based) and non-destructive methods (pXRF) as well as traditional thin section petrography were undertaken using outcrop samples as controls while artefacts were only analysed non-destructively using pXRF. As a result, a new method for analysing coarse-grained rocks with pXRF was developed.

The goal of this chapter is to demonstrate a robust method used to differentiate between granite plutons in Belize using whole-rock analysis using pXRF. This method may enable further archaeological provenance work in Belize to assess which granitic plutons were being exploited to make groundstone tools. To fully illustrate the need for this work, a brief background of the geology of the Maya Mountains will be discussed. Next, is an in-depth discussion of the methodology developed for this project. Following is a description of the methods used on archaeological material at Pacbitun. The results of the comparative results of non-destructive pXRF, destructive XRF, and destructive thin section analysis on outcrop samples will be discussed next. Lastly, the application of this methodology to the provenance of archaeological artefacts from the site of Pacbitun and the significance of these findings will be detailed.

Background

Groundstone tools occur in the archaeological record of nearly every society. The tools examined in this chapter are manos (approximately 20-50 cm in length) and metates (approximately 60+ cm on the longest axis). These are common household tools used for grinding corn or any material that needs to be powdered or reduced to a meal (Adams 1999; Biskowski 1997; Odell 2000, 2001). Manos are active hand tools that are dragged across the surface of the larger, stationary metate. The raw materials used in the production of manos and metates vary greatly and are largely dependent on what is available either locally or through accessible exchange routes (Adams 1999; Drennan 1984).

In Belize, metates are largely constructed of limestone, sandstone, slate, quartzite, rhyolite, basalt (vesicular and non-vesicular), and granite. Granite is the most abundant igneous material in Belize and is commonly used by the Maya of Belize for the construction of manos and metates (Bateson and Hall 1977; Graham 1983, 1987b; Shipley and Graham 1987). Its hardness and abundance make it a useful raw material for groundstone tools, which is reflected in its presence in the archaeological record. Granite was chosen for this provenance study because of its abundant use in the archaeological record as well as the relatively restricted nature of granite outcrops in Belize (Figure 15.1).

The focus of this work is on granite from three geographically distinct plutons within the Maya Mountains: Mountain Pine Ridge, Hummingbird Ridge, and Cockscomb Basin (Dixon 1956). Hummingbird Ridge and Cockscomb Basin are both described as two-mica granites (e.g., Bateson 1972; Bateson and Hall 1977; Dixon 1956; Jackson *et al*. 1995; Ratschbacher *et al*. 2009; Shipley 1978; B. Weber *et al*. 2012). In a hand sample, Mountain Pine Ridge granite can generally be differentiated from the other two plutons by the presence of bright pink potassium feldspar. Otherwise, the three granites are difficult to distinguish visually, making chemical or mineralogical analysis necessary.

Calibration, accuracy, and precision have been the primary issues of pXRF work. Calibration methods vary by manufacturer. The unit used in this work is an Olympus Delta© pXRF and utilises a proprietary coin to ensure the unit is functioning properly by measuring count rates. However, an internal calibration does not always result in analyses that reflect the true geochemical signature of a known material. This concern can be addressed by analysing geologic reference materials prior to experimental analyses or by using multiple techniques (e.g., neutron activation analysis, inductively coupled plasma atomic emission spectroscopy, and lab-based XRF) to analyse unknown materials, as was done by Mitchell *et al*. (2012) and Craig *et al*. (2007) in their research on stoneware and obsidian, respectively. Comparative work such as this has not been conducted on granite until this project. Piercey and Devine (2014) examined the ability of pXRF to accurately and precisely generate data on powdered silicate rocks. Using known powdered geologic reference materials, it was possible to determine which elements behaved most normally for their specific unit. Piercey and Devine (2014) found that with the use of a single point calibration method it was possible to obtain both accurate and precise data using pXRF on a powdered sample. That is, when dealing with a fine powder a single point of analysis was able to accurately capture the geochemical variation within the sample.

In addition to ascertaining the analytical pros and cons of a pXRF unit, having a robust database of source-rock geochemical variation is vital to sourcing projects. Today's obsidian provenance studies are supported by extensive databases of known obsidian sources with geochemical information obtained through lab-based XRF, neutron activation analysis, or other mass spectrometry methods (Craig *et al*. 2007; Frahm 2012, 2014; Nazaroff *et al*. 2010). Without known source-rock geochemical signatures, the results from pXRF work are largely limited to differentiating groups within a sample set of artefacts. The need for a source-rock database to support this study necessitated sampling and outcrop mapping of potential granite outcrops in the Maya Mountains.

Pacbitun is home to the only known granite groundstone workshop in Belize (Ward 2013) and is located approximately 5 km from the nearest granite outcrop within Mountain Pine Ridge. Granite debitage makes up the majority of the collection, with thousands of kilograms of flakes from the groundstone tool production process. Current work has focused on the excavation of the mano workshop (see chapter fourteen, this volume; Balinger *et al*. 2015; Skaggs *et al*. 2016a; Tibbits 2015; Ward 2013). This project sought to analyse the geochemistry of the tools excavated from the site and to attempt to determine a source location for the tools using only non-destructive pXRF.

Methods

Granite outcrop samples were collected during three field campaigns (2013, 2014, 2015) in the Maya Mountains, Belize. Each pluton was sampled as extensively as physical access (by vehicle and on foot) and private property permission allowed. Forty-three discreet localities were sampled (Hummingbird Ridge = 11, Cockscomb Basin = 13, Mountain Pine Ridge = 19; Figure 15.1). Samples collected directly from an outcrop are referred to as being from primary locations. This is in contrast to secondary locations, which refers to samples collected from a deposit that is not the original outcrop, i.e., streambeds. Granite cobbles were collected from streams draining each pluton because it is likely that the Maya were not always quarrying directly from the outcrop but rather were opportunistically gathering boulders and cobbles from river ways (Hayden 1987b).

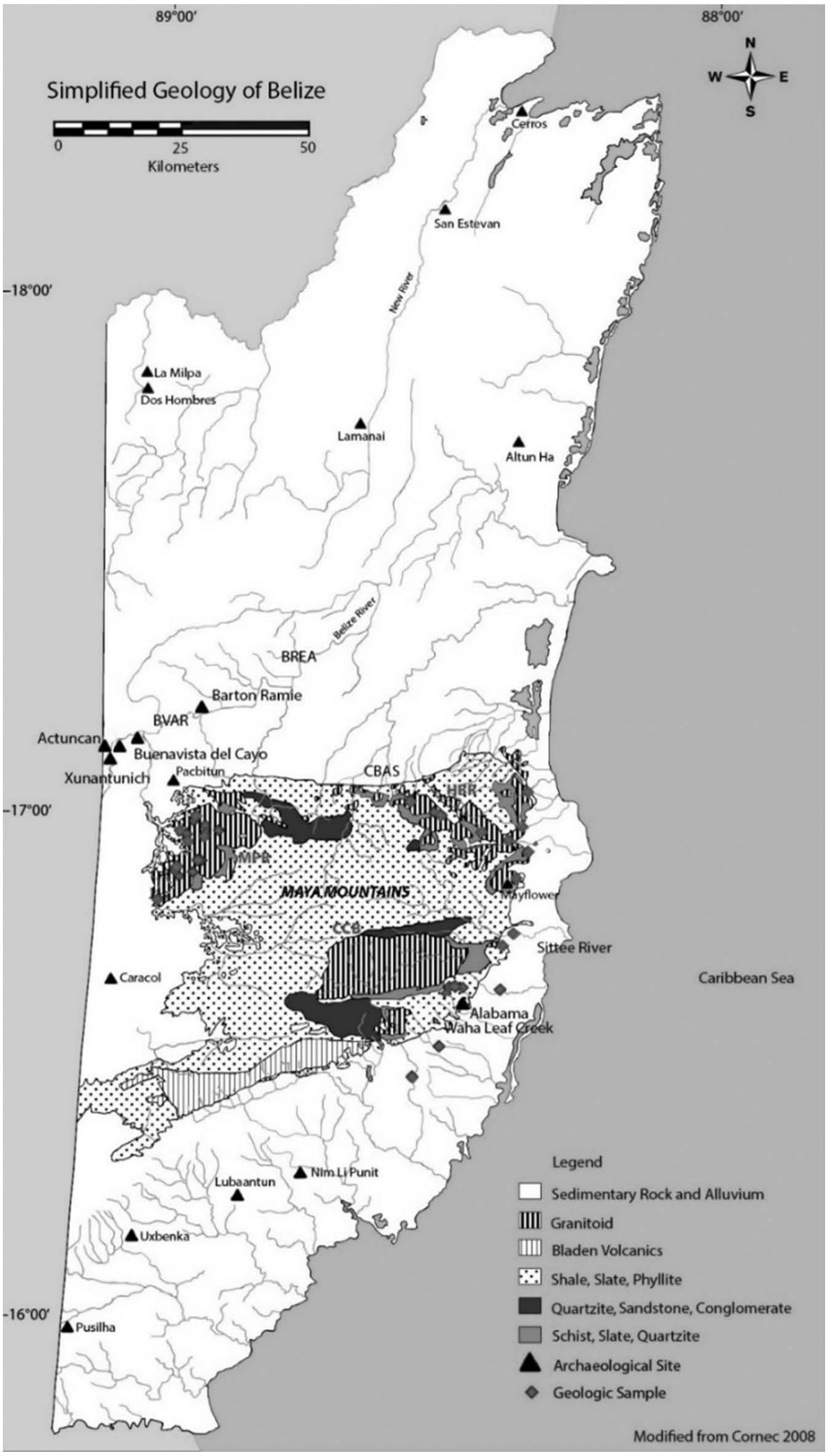

Figure 15.1. A simplified geology of Belize. Major archaeological centers and sites that were analysed in this project are identified by triangles. Geological sample locations are denoted by diamonds. Acronyms represent archaeological permit areas. BREA: Belize River East Archaeology Project; CBAS: Central Belize Archaeological Survey; BVAR: Belize Valley Archaeological Reconnaissance. MPR: Mountain Pine Ridge; HBR: Hummingbird Ridge; CCB: Cockscomb Basin.

Outcrop samples were prepared as thin section slides. All petrographic thin sections were prepared in-house at the University of Iowa Department of Earth and Environmental Sciences thin section lab. Thin sections were 2″ by 1″ and had no cover. Quick polish was applied to all thin sections. The six thin sections that were used for electron microprobe work were also probe polished and then carbon coated. Thin sections were analysed with Nikon Alphapot-2 POL petrographic microscopes using both polar and cross-polar light with ¼ wave and tint plate.

Each thin section was analysed and characterised by the author. The majority of thin sections were constructed from samples collected during the 2013 season. As this season was largely exploratory in nature, some of the thin sections were of granite collected in secondary locations and, therefore, were removed from the study and replaced with granite from primary locations. Thin sections chosen were the most representative of each pluton based on the sample set collected. These thin sections were then photographed using a Nikon Coolscan slide scanner. From these thin section slides, portions of the remaining sample were powdered for analysis with pXRF and XRF, allowing for a direct comparison of the same sample across three methods.

An Olympus Delta© pXRF with a beam diameter of 10 mm was used in all pXRF analyses conducted during this project. The machine was set to Geochem mode, which engages two energy beams (10 keV, 30 keV); each beam was set to run for thirty seconds. The unit itself uses miniaturised X-ray tubes with a silicon drift detector and 6µm prolene window. The detection range on Geochem mode ranges from magnesium to uranium (Mg to U). The data from Geochem mode is internally converted into weight percent, which then were converted to percent oxide for the major elements and ppm for minor and trace elements.

The 10 mm beam diameter on this unit has the potential to bias the results from a coarse-grained rock by analysing a single mineral at a time or a subset of minerals that may or may not be representative of the modal abundances of mineral phases present (Figure 15.2). A typical Maya Mountain granite has quartz, plagioclase, and potassium feldspar crystals that average 8-10 mm but can reach up to 2 cm in length. The micas present average less than 1 cm on the longest axis. These large grains mean that it is possible to only analyse one or two mineral grains with a single pXRF shot. To account for the large grain size of these granites it was necessary to determine the number of sample points to be averaged in order to obtain a signature from a hand specimen that is indistinguishable from that of a powdered sample used in lab XRF. The rocks used for this analysis are also used for powdered pXRF, lab-based XRF, and thin section petrography.

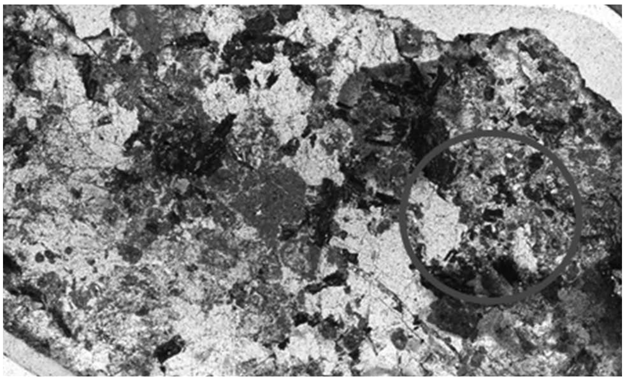

Figure 15.2. Scaled comparison of the 10 mm diameter pXRF beam size compared to a 3.5 cm long petrographic thin section showing issues with sample size versus unit of analysis.

The granite analysed yielded measurable amounts of: Al, Si, P, K, Ca, Ti, Mn, Fe, Zn, Rb, Sr, Y, Zr, Pb, and Th. By constructing bivariate plots of the results from loose-powder geologic reference materials: GS-N (granite from Department of Analysis of Rocks and Minerals-National Centre for Scientific Research, France), JA-1 (andesite from the Geological Survey of Japan), BCR-2, and AGV-2 (basalt and andesite respectively from the United States Geological Survey), it was possible to determine which elements were consistent over time and which varied significantly.

Outcrop samples were transported to the University of Iowa for analysis. Samples were washed as necessary with milli-Q© water and thoroughly dried prior to analysis. After washing, samples were cut with a rock saw to provide a smooth, unweathered surface as well as to provide billets for petrographic thin sections. Flat surfaces were analysed to minimise issues regarding the beam hitting the surface at an oblique angle.

Over a three-year period, a dataset of values for all elements was developed using geologic reference materials to assess the accuracy of the internal calibration over time. These measurements were taken on loose powder samples that were analysed prior to the pXRF analyses on outcrop or archaeological samples. The use of aforementioned geologic reference materials helped resolve calibration issues and determined the accuracy and precision of this specific pXRF unit. They were chosen because they represent the broadest range of elements that could be present in the Maya Mountain granite. By using these geologic reference materials, it was possible to determine the accuracy of the pXRF and identify errors in detecting some elements that were larger than desired. This also allows for the determination of whether the results are quantitative, semi-quantitative, or purely qualitative.

To determine the number of data points needed to generate an average composition within error of the bulk geochemical signature of a granite, a Monte Carlo Simulation was conducted (Tibbits 2016). Fifty data points taken in a grid pattern every centimetre was analysed for three granitic samples, one from each pluton. The Monte Carlo Simulation produced averages of one to fifty randomly selected points. Results indicate that five data points are the minimum number of data points needed in this study to consistently generate data that is within one standard deviation of the expected value as defined by lab-based XRF. For each element, the average of five randomly selected points was within one standard deviation for the results of a fifty-point average. This implies that five is the minimum number of randomly selected data points necessary to generate an average geochemical signature of granites from the Maya Mountains.

To test the results of the Monte Carlo Simulation, five randomly selected data points were analysed on a set of whole rock samples. After the whole rock analysis, the samples were ground into a powder. All equipment was cleaned prior to the introduction of a sample. The whole rock sample was fed into a steel jaw crusher. Pieces that were larger than 5 mm after the jaw crusher were separated from the finer pieces to avoid damaging the ceramic ball mill. The small chips from the jaw crusher were then powdered to a fine flour in a ceramic ball mill. The powders were then placed in small plastic powdered sample containers with Chemplex© prolene film covering the end that would be analysed. The powders were then analysed with the pXRF, using the Geochem mode with the same settings used previously on the whole rock samples. The powders used in this analysis were the same as those sent to the Illinois State Geological Survey for XRF analysis, continuing to ensure consistency in the samples analysed across methods.

Lab-based XRF analysis was conducted on the same powdered samples that were used in the pXRF and thin section work. The powdered samples of hand samples described above were sent to the Illinois State Geological Survey for XRF analysis using a Rigaku NeX CF EDXRF spectrometer. This model utilises indirect excitation of samples via a 50w palladium anode. There are five secondary targets in the instrument: LEO, RX9, copper, molybdenum, and aluminium. The XRF unit has a silicon drift detector with a resolution ranging from 127 to 145 eV at manganese Kα1. Concentrations were calculated at the lab using proprietary fundamental parameter software from Rigaku.

Granitic artefacts were analysed by pXRF using an Olympus Delta© family unit. When analysing archaeological materials, an experimental methodology based upon the results of the Monte Carlo Simulation was applied. Prior to any pXRF analyses of artefacts, powdered geologic reference materials GS-N, JA-1, and AGV-2 were analysed. By doing this, a calibration curve could be developed, and any drift could be accounted for. All archaeological artefacts were analysed on smooth, clean surfaces. No fewer than five data points were collected from each artefact. These individual data points where then averaged into a bulk geochemical signature for each individual artefact. Visual observations of mineral content and petrography as well as photographs of each artefact were taken at the time of analysis.

Results

Thin section analyses were consistent with the previous findings that the three plutons are petrographically distinct (Bateson and Hall 1977; Dixon 1956, Jackson *et al.* 1995; Table 15.1). In general, Mountain Pine Ridge has the largest grains and least amount of weathering evident in thin section. Hummingbird Ridge has quartz present only in the interstitial grains. Cockscomb Basin tends to exhibit perthitic texture. The major minerals show little replacement. However, many accessory minerals have been partially to completely replaced in all plutons. Specifically, biotite tends to be partially to completely chloritized in all three plutons.

The three plutons vary slightly in the proportion of major minerals; however, the proportions of minor minerals can be used to readily differentiate between the plutons (see Tibbits 2016). Mountain Pine Ridge has sheet silicates present in the spaces between major minerals. The sheet silicates are small and comprise a smaller percentage of the overall rock. Hummingbird Ridge and Cockscomb Basin both have higher proportions of sheet silicates; however, Cockscomb Basin has more biotite and Hummingbird Ridge has more muscovite. Bateson and Hall (1977) also noted small amounts of accessory magnetite in Mountain Pine Ridge and Hummingbird Ridge while Cockscomb Basin has monazite and rutile.

Macroscopically, these variations are not distinct. It has been proposed that the presence of pink orthoclase feldspar (k-spar) in hand sample is indicative of Mountain Pine Ridge granites, however the author encountered and collected pink granite from the Cockscomb Basin during the fieldwork for this project. Despite the presence of pink granite in Cockscomb Basin, the majority of visually pink granite groundstone artefacts are geochemically similar to Mountain Pine Ridge. Distinguishing between Hummingbird Ridge and Cockscomb Basin in hand sample is very difficult as the colour range for biotite and muscovite can often overlap. In short, pink granite is generally from Mountain Pine Ridge but this should not be used as a diagnostic feature.

Table 15.1. Observed average modal abundances of major and accessory minerals identified in mountain Pine Ridge, Hummingbird Ridge, and Cockscomb Basin granite.

Pluton	Major Minerals	Accessory Minerals	Additional Minerals
Mountain Pine Ridge	Quartz: 25% Plagioclase: 3 0% Orthoclase: 35%	Biotite, chlorite, muscovite, apatite, Fe-Ti oxides (approx. total 10%)	---
Hummingbird Ridge	Quartz: 30% Plagioclase: 25% Orthoclase: 30%	Muscovite > biotite, chlorite, apatite, Fe-Ti oxides (approx. total 15%)	---
Cockscomb Basin	Quartz: 25% Plagioclase: 30% Orthoclase: 30%	Biotite > muscovite, chlorite, margarite, Fe-Ti oxides (approx. total 15%)	Bateson and Hall (1977) reported monazite and rutile

By analysing known international standard reference materials prior to any experimental work, it is possible to show that there is very little drift in the major elements analysed in the unit used for this project over the course of three years (Tibbits 2016). The results indicate the Olympus Delta© used does not share the accuracy issues found in the Olympus X5000 (Piercey and Devine 2014). Additionally, when these results are compared to published data available on the Geological and Environmental Reference Materials online database (Jochum *et al.* 2005), there is little difference between the results obtained by pXRF or those using other techniques (Table 15.2, for all geologic reference materials see Tibbits 2016). In addition to this, GS-N and AGV-2 were analysed on repeat to assess the variation that occurs within a single day (Table 15.2). Through this analysis it was possible to determine which elements were consistently measured accurately and precisely.

By using the geologic reference materials consistently, it was possible to compare measured pXRF values directly with the expected concentrations. This control allowed for the development of calibration curves, which could be used as needed. During this project, the pXRF unit was factory-set with an internal calibration within the range of expected variation for the geologic reference materials for most elements. A calibration curve was not needed for this project.

The results of the Monte Carlo Simulation were reinforced by the comparison of whole rock and powdered samples. Results obtained on powdered samples with lab-based XRF at the Illinois State Geological Survey and pXRF using an Olympus Delta© unit are also statistically significant. Pearson's correlation and Spearman's rho values in all but one case (Figure 15.3, Table 15.3, marked

Table 15.2. Comparison of geochemical values obtained on known granite geologic reference materials AC-E and GS-N. * indicates values obtained from results published on GeoReM, the other value is the average of multiple runs over time. Major elements are show in ppm. Experimental data shown are from a year of analyses. The standard deviation for running these analyses on GS-N on repeat 25 times consecutively are included to demonstrate the consistency within a run. Results shown here are representative of the results for all geologic reference materials measured during this project (complete list in Tibbits 2016).

	Rb/Sr	Sr/Y	Al_2O_3	K_2O	MnO	P_2O_5	SiO_2	TiO_2	Zn	Y	Sr	Rb	Zr
AC-E*	54.29	0.015	14.70	4.49	0.06	0.01	70.35	0.11	224	184	2.8	152	780
AC-E, n =31	130.5	0.006	14.05	4.82	0.07	0.16	55.59	0.68	252	190	1.5	151	822
Standard Deviation	--	--	0.38	0.17	0.003	0.017	24.3	1.28	9.0	1.28	1.5	2.12	10.3
GS-N*	0.32	35.6	14.90	4.63	0.06	0.28	65.80	0.68	48	16	570	185	235
GS-N, n=44	0.31	32.9	15.1	4.94	0.05	0.21	54.05	1.2	55	18	607	188	219
Standard Deviation over time	--	--	1.53	0.25	0.005	0.04	21.4	1.37	8.7	1.8	9.4	4.6	6.6
GS-N Standard Deviation repeated run	--	--	0.25	0.04	0.00	0.01	0.7	0.03	4.8	1.5	6.4	2.8	5.0
AGV-2 Standard Deviation repeated run	--	--	0.22	0.02	0.00	0.01	0.38	0.03	4.6	1.5	5.3	2.0	3.2

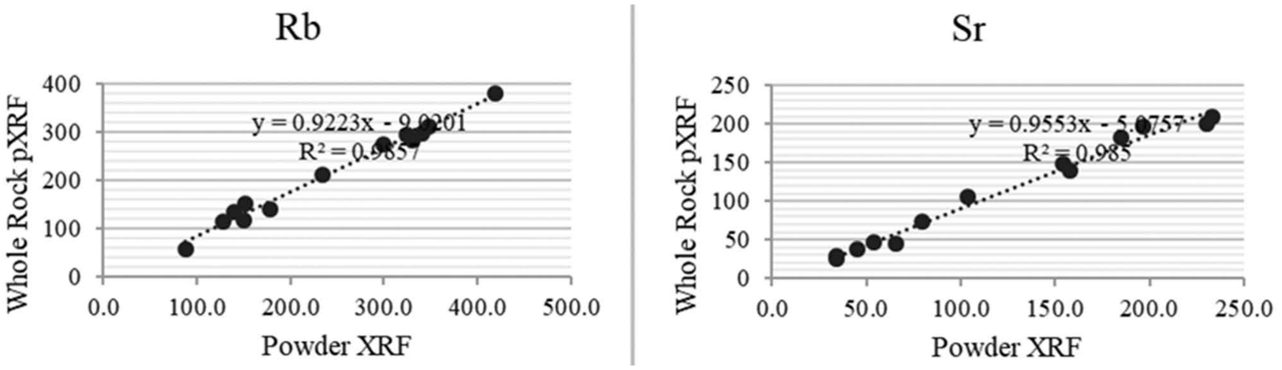

Figure 15.3. Comparison of whole rock pXRF results and XRF results on powdered samples. Rb, Sr, and Y provided results with high r2 values and were statistically significant. Full list of Rb, Sr, and Y values are in Table 15.3.

Table 15.3. Comparison of results from pXRF and lab-based XRF techniques showing Rb, Sr, and Y results. Results are typical of most elements that were analysed in this project. Spearman's rho (>0.98) and the Pearson correlation value (>0.98) are statistically significant at the 0.01 level for a two-tailed analysis except for the comparison of powdered pXRF and XRF values for HB Teak.

Sample	Analysis	Rb, ppm	Sr, ppm	Y, ppm	Sr/Y	Rb/Sr
CS 5-28-5	Whole Rock, pXRF	151	201	17	0.7	11.9
	Powdered Sample, pXRF	154	227	22	0.7	10.3
	Powdered Sample, XRF	152	230	24	0.7	9.5
CS Aug Cr	Whole Rock, pXRF	139	196	41	0.7	4.8
	Powdered Sample, pXRF	168	184	29	0.9	6.3
	Powdered Sample, XRF	179	197	46	0.9	4.2
HB-HRQ	Whole Rock, pXRF	276	46	10	6.0	4.6
	Powdered Sample, pXRF	273	48	10	5.7	4.8
	Powdered Sample, XRF	299	54	14	5.5	4.0
HB-MC	Whole Rock, pXRF	296	74	16	4.0	4.5
	Powdered Sample, pXRF	339	76	22	4.5	3.4
	Powdered Sample, XRF	324	79	26	4.1	3.0
HB-Teak	Whole Rock, pXRF	212	106	17	2.0	6.4
	Powdered Sample, pXRF*	173	119	20	1.4	5.9
	Powdered Sample, XRF*	234	104	24	2.2	4.3
HB-Teak-D	Whole Rock, pXRF	57	210	20	0.3	10.4
	Powdered Sample, pXRF	87	225	24	0.4	9.4
	Powdered Sample, XRF	88	233	28	0.4	8.4
MPR 6-4-2	Whole Rock, pXRF	297	28	61	10.6	0.5
	Powdered Sample, pXRF	355	47	79	7.5	0.6
	Powdered Sample, XRF	341	34	64	9.9	0.5
MPR BP	Whole Rock, pXRF	252	18	19	14	0.9
	Powdered Sample, pXRF	362	29	42	12.5	0.7
	Powdered Sample, XRF	371	31	51	12	0.6
MPR-BRF	Whole Rock, pXRF	312	37	38	8.4	1.0
	Powdered Sample, pXRF	327	38	38	8.6	1.0
	Powdered Sample, XRF	340	45	47	7.8	0.9
RC-1	Whole Rock, pXRF	284	45	53	6.3	0.9
	Powdered Sample, pXRF	313	61	45	5.1	1.4
	Powdered Sample, XRF	331	67	52	5.0	1.3
RC-3	Whole Rock, pXRF	135	148	35	0.9	4.3
	Powdered Sample, pXRF	122	134	35	0.9	3.8
	Powdered Sample, XRF	140	154	40	0.9	3.8
SR-1	Whole Rock, pXRF	117	140	22	0.8	6.4
	Powdered Sample, pXRF	140	148	29	1.0	5.1
	Powdered Sample, XRF	150	158	37	1.0	4.2
SR-2	Whole Rock, pXRF	115	183	28	0.6	6.5
	Powdered Sample, pXRF	130	175	38	0.7	4.6
	Powdered Sample, XRF	128	185	49	0.7	3.7
WP-13	Whole Rock, pXRF	380	24	37	15.6	0.7
	Powdered Sample, pXRF	416	28	66	14.9	0.4
	Powdered Sample, XRF	419	34	72	12.2	0.4

by an asterisk) and indicate the correlation between the values is statistically significant at the 0.01 value in a 2-tailed test. These results support the validity of applying the methodology described above when using pXRF technology. Statistical analyses indicate that in all cases the correlation between pXRF data obtained on whole-rock (five data points that were averaged) versus powder are significant at the 0.01 level for a 2-tailed analysis in both Pearson's correlation value and Spearman's rho (for further discussion see Tibbits 2016).

There is an inherent sampling bias between the use of powder and whole rock. The pXRF can analyse beneath the surface approximately 15 mm. In powder, it is possible to analyse many minerals with one data point, both within the 10 mm beam diameter and the 15 mm penetration depth. The powdered samples effectively represent a 3-D view of the sample while the whole rock represented a 2-D slice through a sample. This 2-D slice may not be representative of the modal abundance of minerals present in a 3-D slice. When analysing a whole rock, it is likely that only one or two minerals will be analysed with a single data point. Because of the disparity between grain size and beam diameter and depth, it is necessary to take multiple data points to generate an average geochemical signature for a sample.

The results of the Spearman's rho and Pearson's correlation tests combined with the calibration curves and the results of the Monte Carlo Simulation indicate that five data points can accurately differentiate between plutons (Tibbits 2016). This project does not aim to generate data that is high-resolution enough to distinguish between outcrops within a pluton, this will likely be an avenue of future research for the author. For these reasons, the level of accuracy that can be achieved by pXRF using five data points is acceptable for this project.

The elements Rb, Sr, and Y in granite are relatively immobile elements that are not strongly impacted by weathering, alteration, or cultural activities and are present in high enough proportions that they can be measured with pXRF (Weyer *et al*. 2008). These elements were consistently measured in each sample and artefact, and yielded consistent results during each analysis of geologic reference materials. The results of the analyses on standard geological powders also show that Rb, Sr, and Y are accurately measured by this pXRF unit (Tibbits 2016).

Through multiple bivariate analyses of pXRF data on geological reference materials it was found that Sr/Y and Rb/Sr ratios best differentiate between plutons in the Maya Mountains. Using the current dataset, Mountain Pine Ridge is readily separated from the Hummingbird and Cockscomb granites. It is difficult to differentiate between Hummingbird and Cockscomb granites. Both plutons tend to have a low Rb/Sr ratio; however, Hummingbird Ridge tends to have slightly lower Sr/Y ratios, resulting in a small region of overlap between the two (Figure 15.4).

The use of Rb, Sr, and Y for differentiating between plutons may be problematic if applied to granites beyond Belize. Within the Maya Mountains, no other elements or ratios that can be generated with pXRF data can

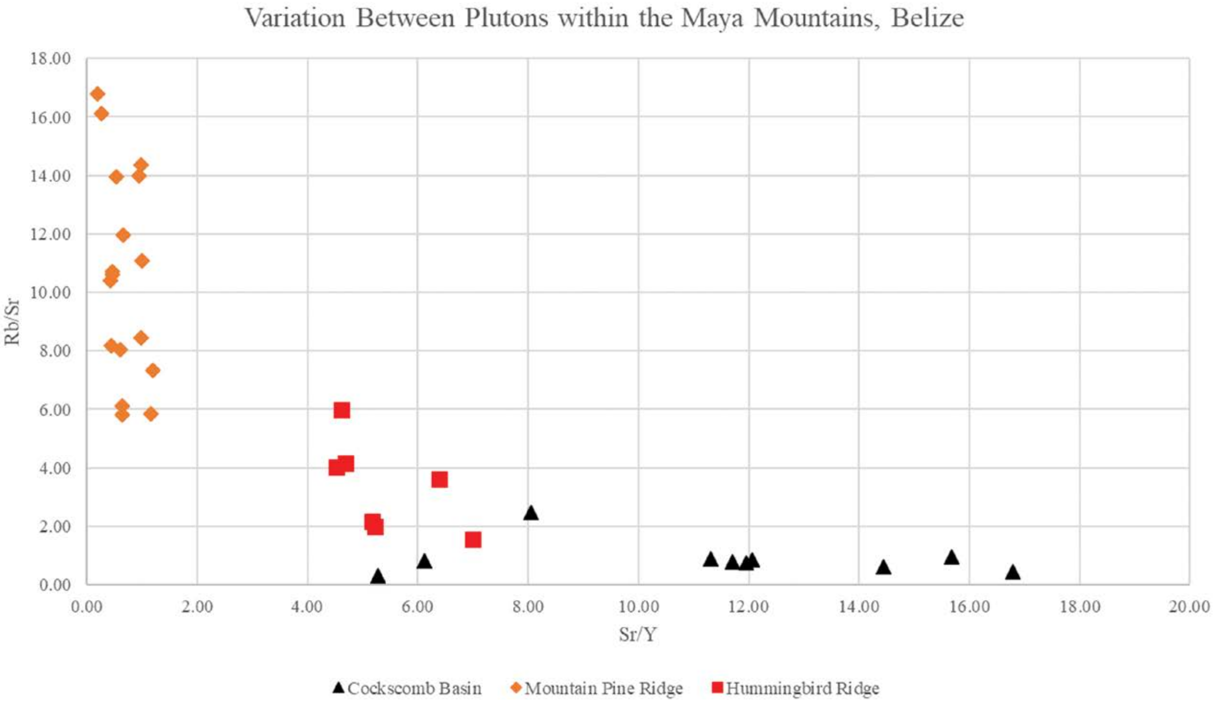

Figure 15.4. Variation within and between plutons as characterised by Rb/Sr and Sr/Y ratios based on whole rock pXRF data. Note the zone of overlap between Hummingbird Ridge and Cockscomb Basin may be the result of crystal fractionation implying a close genetic relationship between the plutons. There are no petrographic differences between the samples in the zone of overlap between Hummingbird Ridge and Cockscomb Basin.

separate Mountain Pine Ridge, Hummingbird Ridge, and Cockscomb Basin. However, strontium can be readily impacted by crystal fractionation within the magma chamber. The relationship between Rb/Sr and Sr/Y seen in Figure 15.4 follows the crystal fractionation curve that develops as a magma chamber crystallises.

A primary concern is whether the granites analysed are truly from the Maya Mountains and not imported granite from Honduras or Guatemala. At this scale, it is necessary to move beyond Rb/Sr and Sr/Y ratios and compare amounts of K_2O, Rb, Zn, and Y from different plutons because it is possible that a granite from a non-Maya Mountain pluton would fall on the range of geochemical variation for Rb/Sr and Sr/Y for Mountain Pine Ridge, Hummingbird Ridge, or Cockscomb Basin. While there is some overlap between the granites from Guatemala and Honduras, the Maya Mountain granites typically have higher amounts of Rb, Zn, and Y which has the potential to be used to distinguish artefacts from Belize from those originating from plutons in Guatemala or Honduras. It is unlikely that granite from Guatemala or Honduras was being quarried or manufactured by the ancient Maya. Ethnographic studies show that when basalt is present, as is the case in both Guatemala and Honduras, it is the preferred material over granite (Hayden 1987a, 1987b; Searcy 2011; Tibbits 2016).

The granite analysed from Pacbitun reflects a preferred source region located within Mountain Pine Ridge. The high-volume of granite material at Pacbitun necessitated the use of a sampling strategy (n=89). A preponderance of the granite was excavated from the Late Classic period (550-800 AD) Tzib Group. Granite debitage from the production process is the most prevalent form of granite within the collection. Raw, partially hewn, and finished manos were also analysed from the Tzib Group collection. From this material, a total of 79 pieces were sampled and analysed using pXRF. From this sample of debitage and partial tools, all had similar geochemical signatures. Seven pieces from Plaza A at Pacbitun were analysed, all were excavated from Middle Preclassic (900-300 BC) contexts, three from Unit 3, two from Unit 2, two from Unit 4 (Cheong 2011). A single artefact was analysed from Plaza B Unit 6 which also dates to the Middle Preclassic (Powis 2011). Two artefacts from the nearby minor centre of Sak Pol Pak were analysed. This site is located three kilometres to the southwest of Pacbitun. The two pieces of granite analysed from Sak Pol Pak are from Structure C-3, Unit 4, Level 2, from the Preclassic Period. Structure C-3 is associated with Plaza C, a restricted zone on the eastern edge of the site core (see chapter two, this volume for additional details on chronology; Reece 2012).

The bulk geochemical signature for each artefact was analysed, and the Rb/Sr and Sr/Y ratios were compared directly to the bulk geochemical signatures obtained from outcrop samples. The results indicate that Pacbitun preferentially utilised granite from Mountain Pine Ridge, the nearest source of granite. The lone exception is an artefact recovered from Sak Pol Pak which most closely resembles the geochemical signature for Cockscomb Basin. However, this piece does lie within the range of overlap between Cockscomb Basin and Hummingbird Ridge, making the determination of provenance difficult (Figure 15.5).

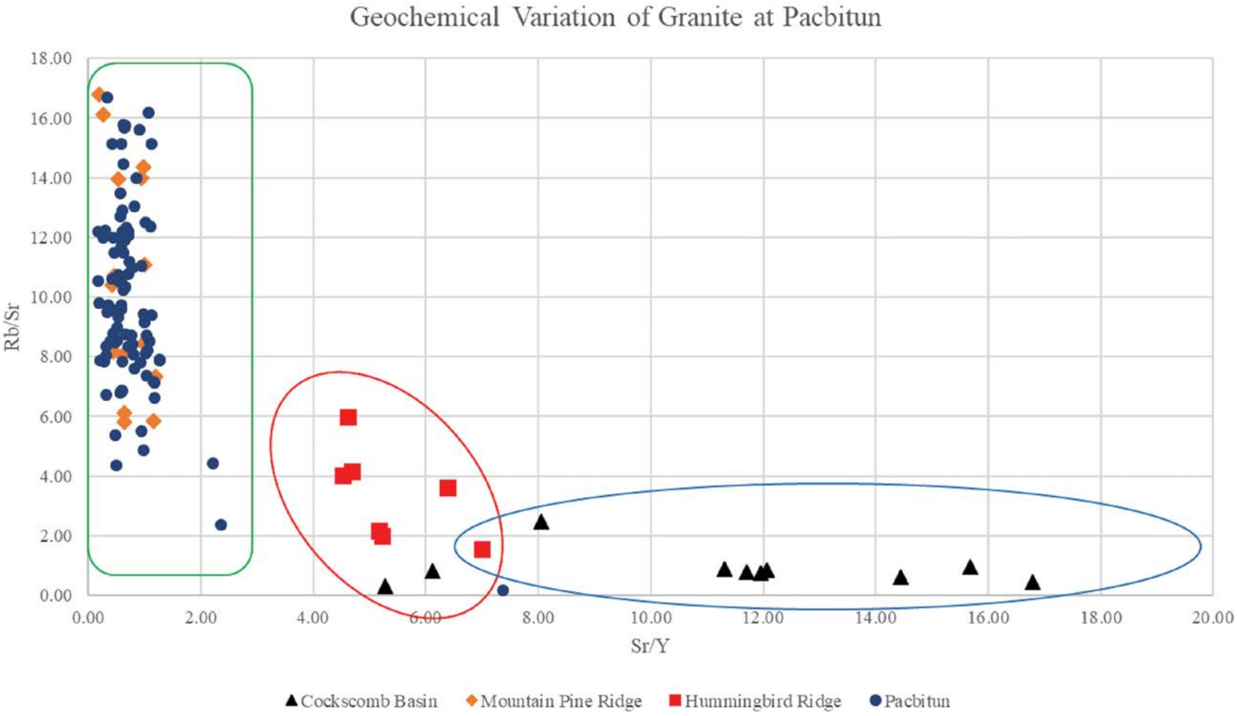

Figure 15.5. Artefacts analysed from Pacbitun fall within the range of expected variation for Mountain Pine Ridge, with one exception. This artefact is most likely from Cockscomb Basin; however, its geochemical signature is similar to that of both Cockscomb Basin and Hummingbird Ridge, making the determination of provenance difficult.

The geochemically distinct tool from Sak Pol Pak was also visually distinguishable from the other granite within the sample. It was visibly finer-grained, lacked pink orthoclase minerals, and was not a mano or metate. Rather the form was similar to an adze or axe. The implications of its presence at Pacbitun remain unclear currently.

Conclusions

Results from pXRF using the methodology outlined in this chapter are comparable to those obtained with lab-based XRF on a suite of elements. It is difficult to distinguish fully between Hummingbird Ridge and Cockscomb Basin in all analyses. The similarities between results across techniques indicate pXRF can be as fit for purpose as lab-based XRF when known geologic reference materials are analysed to develop secondary corrections as needed. Assessing the limitations of the pXRF instrument to be used is needed to produce reproducible datasets.

Testing should be conducted to ascertain which elements are most accurately read, are abundant in the material to be analysed, and are not impacted by weathering or other factors (in this case archaeological activities). The use of geologic reference materials over time enables the researcher to determine if a calibration curve is necessary to provide quantitative data and to document drift or changes in the readings being generated.

Thorough testing may be needed on a pXRF prior to experimental analyses to understand the strengths and weaknesses of a specific unit. By testing geologic reference materials repeatedly, this project was able to assess what elements were appropriate to use for sourcing the granite in Belize.

Portable XRF can produce accurate bulk geochemistry of coarse-grained granite. By using multiple data points per whole rock sample, pXRF can produce bulk geochemical signatures that are indistinguishable from those obtained on powdered samples as well as those generated via XRF. Over time, pXRF can consistently produce accurate and precise results on a suite of elements, including Rb, Sr, and Y, which are able to differentiate between granite from Mountain Pine Ridge, Hummingbird Ridge, and Cockscomb Basin. Thus, the results of this sourcing project are considered robust within the confines of the Maya Mountains of Belize.

Within the site of Pacbitun, 98 percent of granite artefacts tested in this project fall conclusively within the range of variation for Mountain Pine Ridge. This indicates that the nearby mountain range was the most likely source for granite used in groundstone tool production within the site. The granite in the Mountain Pine Ridge can be found in easily accessible locations as boulders and cobbles. This would make them ideal for exploitation by the groundstone craftspeople at Pacbitun. Little to no quarrying would be needed to obtain granite of a suitable size for mano or metate construction, expediting the production process. There are also locations where the granite occurs as large outcrops and would require quarrying to remove for use in groundstone production. Currently, it is not clear if the Maya at Pacbitun were opportunistically collecting granite boulders and cobbles or if there is a quarrying site that has yet to be identified within Mountain Pine Ridge. Further work identifying source locations and exploring the potential to differentiate between outcrops within the Mountain Pine Ridge pluton could determine where the Maya of Pacbitun were obtaining their raw materials for groundstone tool production.

Acknowledgements

I would like to thank Dr. Terry Powis, Dr. Sheldon Skaggs, and George Micheletti for their tireless work at PRAP and on this volume, letting me conduct my dissertation research at the site, and having me be a part of this book. Thank you to the Institute of Archaeology for their continued support of archaeological work in Belize. I would also like to thank the numerous University of Iowa funding sources that have helped support my research: Graduate Student Senate, Center for Global and Regional Environmental Research, T. Anne Cleary Doctoral Fellowship, Stanley International Travel Award, Littlefield Fund, and the Department of Earth and Environmental Sciences. Thank you to Dr. John Morris, Dr. Jaime Awe, Dr. Meaghan Peuramaki-Brown, Ellie Harrison-Buck, Dr. Julie Hoggarth, Dr. Lisa LeCount, Dr. Laura Levi, Dr. Fred Valdez, and Dr. Gabe Wrobel for their help completing this research. Lastly and most importantly, I would like to thank Matthew, Art, Sarah, Lauren, and my family for the continued support.

16

The Terminal Classic at Pacbitun: Evidence from Moulded-carved Ceramics

Christophe Helmke and Carmen Ting

The Terminal Classic period (ca. AD 800-950) was a period of great change and transformation across the central Maya lowlands. The various social and historical processes that brought about these changes, and their interplay with climatic and environmental features, continue to be the source of much debate. Yet, the archaeology clearly demonstrates that the period saw the eventual depopulation of most major centres in the central lowlands. The Terminal Classic Tzib phase at Pacbitun remains a poorly understood phase of occupation, given that the upper end of the phase has yet to be documented and given the paucity of materials associated with that phase in the monumental epicentre. Whereas little evidence can be mustered for continued occupation and use by the royal elite residing and operating within the epicentre, the surrounding settlement attests to occupation and populations during the Tzib phase (Campbell-Trithart 1990; Sunahara 1995). One key piece of evidence are the moulded-carved ceramics found in these contexts, which serve as a salient horizon marker for the Terminal Classic (e.g., Helmke and Reents-Budet 2008; Smith 1958). Thereby, attesting for the presence of this type not only serves as a proxy for continued occupation, but the differential spatial distribution of this type across the site equally speaks of continued occupation by differing social segments.

This chapter describes the Terminal Classic sherds of moulded-carved vases recovered from the peripheral settlement and the epicentre of Pacbitun. The data presented herein is part of a growing database on identical ceramic specimens from more than two dozen archaeological sites in both Belize and Guatemala (Figure 16.1). We will provide an overview of this type, as well as consider the spatial and temporal incidence of these ceramics. Information concerning the physical characteristics of the Pacbitun sherds is presented at the close of this chapter. This collection was first examined by the senior author in 1999, at the Archaeology Laboratory of Trent University in Peterborough. From these analyses an unpublished report was produced (Helmke 2000b) upon which the present chapter is based in part. The second author has worked extensively on Terminal Classic moulded-carved ceramics as part of her graduate research (Ting 2008, 2014), focusing especially on petrographic analyses and technological characterizations. In 2018, she analysed the collection petrographically in the Wolfson Laboratories for Archaeological Science at University College London, enabling us to present some of the salient features and surface treatment, as well as paste characterizations of the Pacbitun collection.

The materials reported on here were recovered as part of the initial test-pitting excavations conducted by Paul F. Healy in 1984 (Healy 1985) as well as the subsequent research undertaken by the Trent University-Pacbitun Archaeological Project, proper (see chapter two, this volume; Healy 1990a; Healy *et al.* 2007). The results of this work are presented in a series of graduate theses (see Bill 1987; Campbell-Trithart 1990; Sunahara 1995). Since then the archaeological site has been the focus of investigations by a series of different archaeological projects, including the Belize Valley Preclassic Maya Project, under Paul F. Healy, the Belize Valley Archaeological Reconnaissance Project, directed by Jaime J. Awe and, since 2008, by the Pacbitun Regional Archaeological Project, under the direction of Terry G. Powis (see chapter one, this volume). As part of more recent excavations, further examples of Terminal Classic moulded-carved ceramics have been found at the site, including a production mould for such vases, discovered in Actun Xtuyul, a nearby cave (Spenard and Helmke 2020). These latter specimens are not reported on here.

Comments on Type, Mode, and Paste

The moulded-carved specimens in question are particularly diagnostic of the surface treatment, decorative modes, and form of the vessels from which these sherds derive. The elaborate panels and the decorative modes of these vessels are so distinctive that these can be sorted immediately in the field.

The types that are defined by stylistically similar decorative modes and similar surface treatments are the Pabellon Moulded-carved (Adams 1971; Culbert 1993: Figure 98cl; Sabloff 1975:194-198; Smith and Gifford 1966), Sahcaba Moulded-carved (Culbert 1993: Figure 145a; Smith 1955:Vol. 1:34, 43-45, 194, 195; Vol. 2: Figures 44j, m; Figures 86 i, m, o; Smith and Gifford 1959; 1966) and the most recently-defined Ahk'utu' Moulded-carved type (Helmke 2001; Helmke and Reents-Budet 2008; Ting 2008, 2014; Ting and Helmke 2013; Ting *et al.* 2014, 2015). All of the ceramics that are presented in this chapter can be identified as belonging to the third type, as no specimens have been identified as belonging to the first two types at Pacbitun.

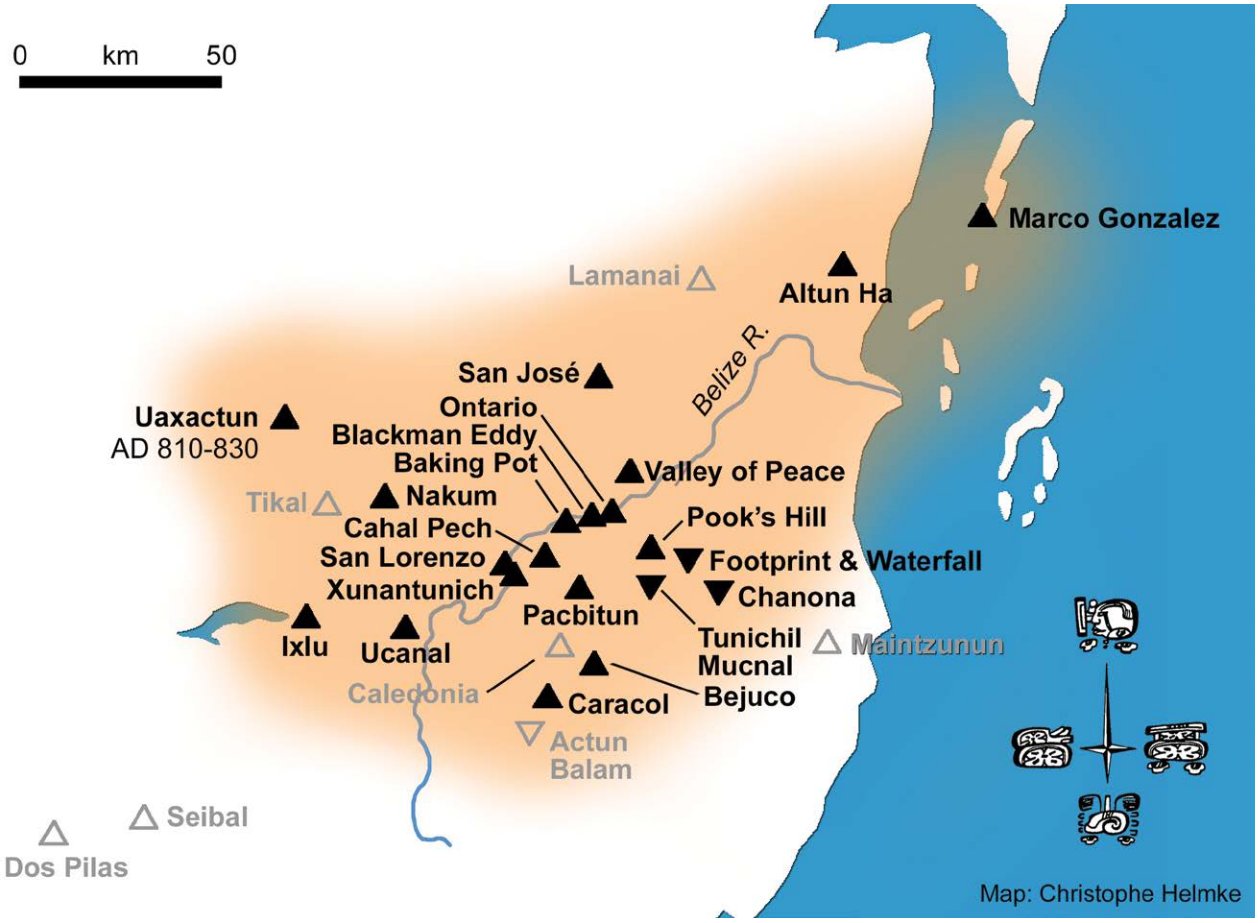

Figure 16.1. Distribution sphere of Ahk'utu' Moulded-carved specimens in the Terminal Classic. Note the location of Pacbitun near the centre of that sphere (after Helmke and Reents-Budet 2008: Figure 6).

Prior to the establishment of the Ahk'utu' type, stylistically similar specimens had been identified in Belize but were erroneously attributed the label of Pabellon Moulded-carved, or more tentatively the designation of 'Imitation Pabellon Molded-carved', based on the realisation that these locally produced ceramics could not be assigned to the Fine Orange ware that is diagnostic of Pabellon. The reluctance of assigning these specimens to an established type was warranted since these are neither Pabellon nor Sahcaba. These two established Peten types differ from the Belizean specimens in numerous ways including paste characteristics, form, iconographic programmes, and the presence of viable glyphic texts (see Helmke *et al*. 1998; Helmke and Reents-Budet 2008). As a result, many of the specimens in question were provisionally designated as 'Belize Modeled-carved' (Awe 1985: Figure 100; Graham *et al*. 1980:166; Graham 1987a:79; Helmke *et al*. 1998; Walsh 1985:137). By now more than 400 sherds of these vessels have been unearthed in Belize and the Peten since the 1930s and these specimens can now be properly classified as to the Ahk'utu' Moulded-carved type.

When Smith and Gifford established the Pabellon and Sahcaba types for the Uaxactun material they identified the surface treatment as modelled-carved (Smith and Gifford 1959, 1966). In his analysis of the Altar de Sacrificios material of the same type, Adams suggested an alteration of the surface treatment designation to moulded-carved (Adams 1963, 1971; see also Ball 1977), a change that has been adopted and maintained by later research, up to the present. This modification was based on the observation that the decorative scenes were predominantly produced with the use of a mould or template and that the finer details were subsequently applied by a combination of gouging, carving, and incising (Gifford and Kirkpatrick 1996). In keeping with this change, the designation of moulded-carved has been maintained by other ceramicists in their analyses (e.g., Ball 1977). The Belizean examples were produced by analogous means and thus the moulded-carved designation is applied to these specimens also (e.g., Graham *et al*. 1980:164; Helmke 1999a).

Ahk'utu' Moulded-carved ceramics enjoyed a wide distribution in the Terminal Classic throughout central and northern Belize as well as in the adjoining eastern Peten. Although several varieties are beginning to be identified on the basis of iconographic, epigraphic, and paste constituents, all Ahk'utu' Moulded-carved specimens have the same vessel shape and all have the same set of decorative modes (Helmke 1999b). Of these, the iconographic programme and hieroglyphic text that adorn them are particularly characteristic and diagnostic. In earlier studies, the coherence of the iconographic programme was recognised and these were attributed the designation of 'Caves Branch' iconography, since some of the earliest specimens of this type were discovered in caves of that area (Graham *et al.* 1980; Helmke 1999b; Pendergast 1982, 1990). Analysis of the Ahk'utu' 'type' reveals that these specimens cross-cut four of the five wares identified at Barton Ramie for the Spanish Lookout Complex (Helmke 1999b). With the exception of Uaxactun Unslipped, all other wares are represented among the Altun Ha specimens, which thus far represent the largest Belizean collection of this material (see Gifford 1976: Figure 13; Helmke 1999b; Ting 2008, 2014; Ting and Helmke 2013; Ting *et al.* 2014, 2015).

Interestingly, the moulded-carved sherds from Pacbitun are related to the Pine Ridge Carbonate Ware and British Honduras Volcanic Ash Ware. Thus, although the sherds are fragments of vases that had exactly the same shape and decorative modes, identical iconographic programmes and glyphs, as well as analogous surface treatment, these sherds cannot be assigned to a single ware. This is due to the fact that the type-variety system relies on a hierarchical classification of attributes wherein paste characteristics figure prominently in the hierarchy of discriminatory features, employed in the definition of types (see Gifford 1976:9-34). In this and several other contexts the use of paste attributes for the isolation of types splits up identical specimens on the basis of one technological attribute. The information that can be gleaned from the intra-site and regional analysis of pastes and ceramic groups has been evocatively presented by Ball (1993).

Nonetheless, in the same effort, Ball makes a strong point for single-paste variant assemblages being the result of multi-form, multi-type, ceramic groups that may have been fired together as a single lot (Ball 1993: 245, Figures 1 and 2). Thus, although the focus on paste variants in the construction of ceramic groups must remain an important, albeit indirect, component to approach the identification of ceramic production 'communities' (Ball 1993: 245), the importance of form and mode-oriented studies are again relegated to the background (for exceptions see Horn and Ford 2018 and Kosakowsky *et al.* 2000). The type-variety system provides an uneasy compromise between the emphasis placed on paste and the ceramic group versus an emphasis on the combinations of mode and form.

Clearly the vases of the Ahk'utu' Moulded-carved type would have been next to indistinguishable to the ancient

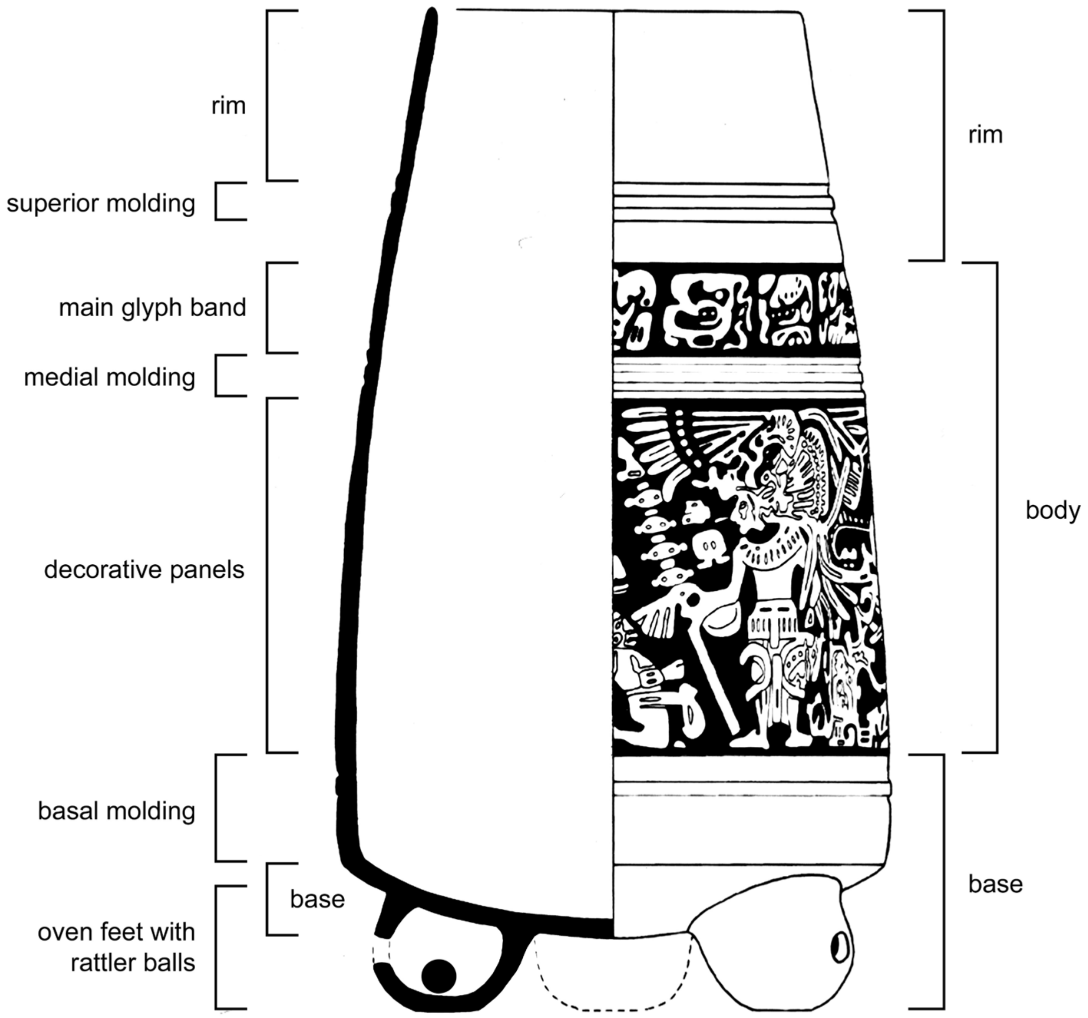

Figure 16.2. Configuration of the decorative modes of Ahk'utu' Moulded-carved vases (after Helmke and Reents-Budet 2008: Figure 3).

Maya consumer (as here we should recall that these are mould-made), the type-variety system imposes from the onset that these identical vessels are artificially split up into separate production types on the basis of paste. From the perspective of the archaeologist and the ancient ceramic manufacturer the distinction between pastes is of great relevance. From the perspective of the ancient Maya consumer, however, these vessels must have been perceived as forming a synonymous and homogenous assemblage. Adding weight to this observation is the fact that all vases of this type are designated by a unique vessel type glyph that is read *ahk'utu'* and which has only been identified on vessels of this type (see Helmke 1999a; Helmke and Reents-Budet 2008; Helmke *et al.* 1998; for comparison see Houston *et al.* 1989). We recognise that the knowledge of raw materials and paste preparations are often socially embedded actions (e.g., Crown 2007; Gosselain 2018). As a result, ancient Maya ceramic production relied on observations of clay sources and their properties, in turn affecting operations of paste preparations. Given these observations, the analytical processes that ceramics are subjected to in modern investigations are well founded. That being said, whereas it remains difficult to fit these moulded-carved vases into the type-variety system, the ancient Maya devised a clear, distinct, and discrete semantic category that disregarded paste attributes. Since the ancient Maya were grouping all these vessels under the same heading it therefore seems heuristically well-founded to keep all of these vases together in the same label, particularly since it is the ancient Maya that archaeology seeks to understand. As such, the solution found has been to devise a type, based on a rather lengthy list of modal features, surface treatment and forms, and relegating paste differences to define 'varieties' of the greater Ahk'utu' type.

Context and Ceramic Associations

Consistently all Ahk'utu' Moulded-carved ceramics are found as part of deposits of the terminal phase occupation, that usually post-date the terminal phase of architectural construction. As such they have been assigned under the heading of peri-abandonment contexts (e.g., Baking Pot, Caracol, Pook's Hill, Structure ATM-M1, Xunantunich) and in instances where continued occupation relies on meagre artefactual deposits these sherds have been assigned to 'post-abandonment occupation' (e.g., Altun Ha) (see Table 16.1; Helmke 2000a, 2000c). The sherds recovered from Pacbitun can, as a whole, be assigned to comparable peri-abandonment contexts as they were recovered from an admixture of collapse debris and humus overlying the terminal architecture, but are also found in burials (Campbell-Trithart 1990:357; 376; Healy 1985:26-27; Richie 1990; Sunahara 1995). Similarly, at Pook's Hill, a fragmentary vase was also recovered from a burial in the eastern shrine (see Helmke 2003). As such, the materials at Pacbitun seem to suggest that these vases were used by the inhabitants of the site in the decades leading up the depopulation and abandonment of the site.

Notable exceptions to this broad generalisation are the specimens recovered from within the core of architectural units from transitional Terminal to Early Postclassic contexts. Despite the existence of such contexts they are extremely limited and, as far as can be discerned, only two such examples exist. Prior to the discovery of the sherds contained in the core of the penultimate architecture of Structure 198 at Baking Pot (Audet and Awe 2000), only the badly deteriorated vase found cached in Structure A-I at Maintzunun was known (Graham 1985:217, 219, 229 no. 1; 1987:79; Graham *et al.* 1980:165).

These vases do not appear to have been common at Lamanai but it would seem logical to expect to find them there in sealed contexts on account of its nearly unbroken sequence of occupation. Nonetheless, based on present evidence, even the Lamanai specimens identified to date 'are found mostly as surface scatters over Late Classic buildings, and only occasionally in Terminal Classic middens' (Graham 1987b:79). Thus, even the Lamanai specimens are also correlated to a type of 'abandonment occupation'.

All moulded-carved specimens are associated with sherds that are diagnostic of the Terminal Classic (AD 800-900). At virtually all sites these vases have been associated with Roaring Creek Red dishes (Gifford 1976:240-243) and related types and forms. Although several other types are found in high frequency with the moulded-carved vases, the Roaring Creek Red type has been singled out. This close association may be due to functional complementarity (for comparable pairings of types and vessel forms, see Helmke 2009).

Several examples of Roaring Creek Red dishes are found with tall pedestal bases, which following an observation made by Graham and Pendergast (Graham 1987:78) can be used for temporal placements. They suggest that the height of the base increases through time and thus may be indicative of gradual temporal variation (see Graham 1987b: Figure 2d, f, h). In addition, the depth of the dish (or basin) supported by the pedestal decreases not only relative to the height of the pedestal but also in terms of actual depth. These characteristics suggest that a micro-seriation can be developed which is reflective of a temporal sequence. Regardless of the height of the pedestal, Gifford had noted that the Roaring Creek Red type itself is a late Spanish Lookout occurrence at Barton Ramie (Gifford 1965:373), more properly assigned to the Late Facet of that ceramic complex. Thus, based on the co-occurrence with the Roaring Creek Red type it may be possible to fine-tune the temporal placement of moulded-carved ceramics after AD 800.

In addition to the Terminal Classic ceramic associations, several contexts also include a small Early Postclassic component, or at least ceramics with features that are deemed characteristic of types of the Early Postclassic ceramic complexes. As these occur outside of sealed contexts within overburden it is usually assumed that these

Table 16.1. List of sites yielding Ahk'utu' Moulded-carved ceramics (after Helmke 2001: Table 4). Some of the figures in this table are superseded by recent findings.

n	Site Name	Frequency		Reference
		vases	*sherds*	
1	Altun Ha	9	89	Helmke 1999b; Pendergast 1979, 1982 & 1990.
2	Actun Nak Beh	1	–	Helmke & Halperin 2001.
3	Actun Tunichil Mucnal	1	–	Helmke *et al*. 1998.
4	Baking Pot	–	15	Helmke 2000a; Audet 2000: Appendix A; Piehl 1998: 44.
5	Barton Ramie	–	1	Gifford 1976: 312, Fig. 208c.
6	Blackman Eddy	–	2	James Aimers pers. comm. 2002
7	Bejuco	–	1	Rafael Guerra pers. comm. 2002
8	Cahal Pech	1	5	Jaime Awe pers. comm. 2003
9	Caracol	1	1	Chase 1994: 173-174, Fig. 13.11m; Chase & Chase 2001: no. 8, Fig. 71.
10	Chanona Cave	1	–	Graham *et al*. 1980: 164-166, 170-171, Fig. 8.
11	Footprint Cave	1	–	Graham *et al*. 1980: 164-166, 170-171, Fig. 7.
12	lxlu	–	1	Helmke pers. observ. 1998.
13	Marco Gonzalez	–	2	Helmke pers. observ. 1998.
14	Nakum	–	5	Jarosław Źrałka pers, comm. 2013
15	Ontario Village	–	5	James Aimers pers. comm. 2002
16	Pacbitun	1	5	Helmke 2000b, Bill 1987: 9, 139; Cambell-Trithart 1990: 357, 376, Fig. 68g; 376, Fig. 70; Healy 1985: 26-27, Fig. 12d; Sunahara 1994: Fig. C-12a. and pers. comm. 1999.
17	Pook's Hill	3	> 200	Helmke 2003, 2006a,b.
I8	Lower Dover	1	>50	Rafael Guerra pers. comm. 2016
19	San Lorenzo	–	2	S. Chase 1992; LeCount 1996: 135-137, Fig, 5.4b, p. 141, 143, 1999: 249, Fig. 9.
20	San José	–	1	Thompson 1939: 145, 148, Fig. 85a.
21	Uaxactun	–	1	Smith 1955: Fig. 44j, 81t.
22	Ucanal	–	1	Dorie Reents-Budet pers. comm. 1996.
23	Valley of Peace	1	–	Jaime Awe pers. comm. 1996.
24	Waterfall Cave	–	1	Helmke 1999c: Specimen 9; Graham *et al*. 1980.
25	Xibalba Camp	–	1	Helmke 2000c.
26	Xunantunich	1	1	Jaime Awe pers. comm. 2001: MacKie 1985: 67, 133, 135, 182, Figs. 16.109, 16.129, Pl. 47, 48.

are late inclusions that are disassociated from the previous occupation.

Consequently, the moulded-carved sherds have been relegated to the Terminal Classic. The Baking Pot data reveal this association and the Postclassic penultimate and terminal architectural modifications confirm the Early Postclassic occurrence of moulded-carved vases (Audet and Awe 2000). At Altun Ha, the majority of deposits in which moulded-carved ceramics occur include a small assemblage of Early Postclassic ceramics, hence their late temporal placement there. As these contexts are mostly non-stratified and mixed, the association prevents conclusive temporal observations. At present more temporal placements on the basis of AMS dates may eventually help to define more specifically the temporal breadth of the Ahk'utu' Moulded-carved specimens.

Dating

The archaeological contexts in which moulded-carved vases are discovered demonstrate that they are almost exclusively found in deposits formed as part of the terminal occupation. The ceramic associations at sites in the greater Belize River Valley suggest strongly that these vases date from the Terminal Classic (AD 800-900+), leading up to a time transitional with the Early Postclassic (see Table 16.2).

Beyond ceramic associations other methods can be used to gauge the temporal occurrence of the moulded-carved vases. A stylistic appraisal of the iconographic programme and specific iconographic attributes therein can be used to correlate these elements to the Long Count: inscribed monuments of the Central Lowlands. In addition, the

Table 16.2. Temporal distribution of Ahk'utu' Moulded-carved vases, based on their incidence in the various ceramic complexes at sites in the eastern central lowlands. Ceramic incidence is compared to the style date of the vases established on the basis of the temporally diagnostic iconographic elements (after Helmke 2001: Table 1).

AD	Archaeological Time Periods	Uaxactun	Xunantunich	Pacbitun	Baking Pot Barton Ramie	San Jose	Altun Ha	Style Date	AD
		Smith 1955	LeCount *et at.* 2002	Healy 1990	Gifford 1976	Thompson 1939	Pendergast 1979-1990	Helmke *et al.* 1998	
1050	Early Post-classic				LF		???	10.11.0.0.0	1050
1000					New Town		Kayab	10.9.0.0.0	**1000**
950		???	???	???	EF	???		10.6.0.0.0	950
900	Terminal Classic (LC3)	Tepeu 3	Tsak'	Tzib	LF Spanish Lookout EF	San Jose V	Pax	10.2.10.0.0	**900**
850								10.0.10.0.0	850
800			Hats' Chaak			San Jose IV	Muan	9.18.10.0.0	**800**
750	Late Classic (LC2)	Tepeu 2					Kankin	9.16.0.0.0	750
700			Samal	Coc	Tiger Run	San Jose III		9.13.0.0.0	**700**
650	Late Classic (LC1)	Tepeu 1					Mac	9.11.0.0.0	650
600								9.8.0.0.0	**600**

three decorative mouldings that frame the iconographic panels also bear a temporal significance. These mouldings also occur on the facades of masonry structures in the northern lowlands. In these contexts, the features have been designated as *atadura* or binding mouldings assigned to Types 1a and 1c (Shelby 1999: Figure 3). Dating of these structures suggests that mouldings of Type 1a and 1c are predominant during the Terminal Classic to Early Postclassic transition (i.e., AD 850-1200), decreasing notably in frequency during the Middle and Late Postclassic (AD 1200-1500) (Shelby 1999: Figure 7). It is of great interest that the date assigned to these vessels on the basis of ceramic associations duplicates the dating obtained for the binding mouldings.

Inspection of the style of the iconography of the decorative panels indicates that comparable programmes are represented on the Terminal Classic stelae of the eastern Peten area. The most similar iconographic programmes are those represented on the latest monuments at Ucanal (Stela 3), Ixlu (Stela 1 and 2), Tikal (Stela 11), and Jimbal (Stela 1). These stelae have been dated between the lahuntun of the tenth Baktun (10.0.10.0.0??) and the second K'atun of the tenth Baktun (1 0.2.10.0.0).

Using the standard Goodman-Martinez-Thompson correlation one obtains a range of dates between AD 840 and 879 (Helmke *et al*. 1998). Unfortunately, with the close of the 9th century, no additional monuments were erected in the area. Thus, the range in dates provided by the style of the iconography should be taken as a lower end range since the iconographic record was abruptly ended, and thus does not serve as a yardstick beyond its cessation.

The overlap in all these sequences secures the time span during which the usage of Ahk'utu' Moulded-carved vases peaked. The range established has been tied to many ceramic sequences and to two style dates that securely delimit the time period during which these vases were used. This period ranges from AD 800 onwards and can confidently be applied to all the specimens that have been discovered outside of clear stratigraphic contexts. Although the upper range has still not been satisfactorily resolved, the usage of the moulded-carved vases may have persisted for some time.

Function

The Maintzunun specimen raises the question of the function of these vessels. As late as 1987, based on the specimens uncovered in caves and the Maintzunun specimen, Graham was inclined to suggest that these vases 'may have functioned solely in a ritual context' (Graham 1987b:79). With the growing number of sherds documented over the past two decades, their functional appraisal has altered. Again, the situation appears to be one of a broad generalization that is interrupted solely by sparse exceptions. The vast majority of moulded-carved sherds are found in association with the domestic assemblage of residential structures and less than 10% of the material is recovered from pyramidal or apparently special function ritual structures. Data from San José, Pacbitun, and Pook's Hill reveal three instances wherein these vessels are found as burial furnishings (Campbell-Trithart 1990; Helmke 2003, 2006a, 2006b; Thompson 1939). Again, these are rather exceptional. Nonetheless, the elaborateness of these vases coupled with their deposition in three burials and at least five caves cannot rule out their secondary ritual function. Unfortunately, the contents of these vases are omitted from the Primary Standard Sequence, which would have shed light on the intended primary function of these vases. The glyphic label assigned to these vases, distinguishes them from the well-known cacao-drinking vases and it can thus be assumed that moulded-carved vases served a different purpose. Unfortunately, the negative evidence does not provide any clues. That being said, the label attributed to these vases suggests that these were 'gifting-implement' (*ahk'-utu'*) and as such these may have served as objects designed to be given as tokens in networks of alliances, particularly within the framework of feasting (see Helmke 2001).

Status

It has been argued elsewhere that these vases may serve as effective status indicators (Helmke 1999a, 2001). This model has been derived from a detailed inter-site comparison of intra-site contexts in which the vases occur. The architectural context with which the vases are found was reduced to measurements of the height and surface area of the supporting platform. Interestingly, at Pacbitun the supporting platforms yielding moulded-carved sherds all fall squarely within the size range derived from the Altun Ha data. It has been determined that the architectural platforms with which moulded-carved sherds are associated at Altun Ha, range in terms of height between 0.90 and 2.90 m and the surface area ranging between 60 to 220 m² (Helmke 1999a, 2001).

Moulded-carved sherds transgress the dichotomy established by Abrams for ancient Maya architecture as 'simple' and 'improved house form' (Abrams 1994). Based on this characteristic alone it can be suggested that moulded-carved vases were utilised by individuals outside of the elite.

Nonetheless, it is the absence of moulded-carved material from upper elite residences (save one sherd from Structure 23 at Pacbitun, see Bill 1987) that serves as a clearer indication that these vases were primarily utilised by non-royal segments of the society. If architectural size and complexity is indeed representative of social status (and this does seem to be the case) then it can be said that the vases were utilised by several segments in the social hierarchy, although a range in the lesser non-royal elite seems best represented. The complete absence of these sherds in common house mounds that are lower than 0.90 m is equally indicative that the lowest social segments did not have access to these vases.

Production and Technology

Three moulded-carved samples of the Pacbitun collection were analysed to explore their compositional and technological characteristics. These samples were recovered from the Trent University-Pacbitun Archaeological Project. The results were then compared with the previous analyses of moulded-carved vases to establish the link between the Pacbitun samples and the broader Ahk'utu' tradition. The Ahk'utu' samples that are also included in the following discussion were derived from Altun Ha, Baking Pot, Cahal Pech, Marco Gonzalez, Mountain Cow, Pook's Hill, and cave sites in the Caves Branch area (Ting 2008, 2014; see also Ting and Helmke 2013; Ting *et al*. 2014, 2015). Macroscopic observation, thin-section petrography, and scanning electron microscopy energy dispersive spectrometry (SEM-EDS) were used to characterise different aspects of production, including raw materials selection, paste preparation, forming, surface finishing, and firing methods. The analyses were conducted by Ting at the Wolfson Laboratories for Archaeological Science at the Institute of Archaeology of University College London.

Raw Material Selection and Paste Preparation

Two fabrics were identified among the Pacbitun samples. Two samples have volcanic ash added as tempering material. These samples are further characterised by the presence of fine-grained quartz, biotite, and plagioclase feldspar inclusions (Figure 16.3a). Such a description corresponds with the previously established Volcanic Ash Subgroup B, suggesting that these vases originated from the Maya Mountains area. The remaining sample is characterised by the presence of crystalline calcite as the principal type of inclusions (Figure 16.3b). The abundance, size, and shape of the crystalline calcite inclusions are consistent with the samples belonging to the Crystalline Calcite Subgroup A, indicating that this vase was likely produced locally at Pacbitun.

The Volcanic Ash Subgroup B and Crystalline Calcite Subgroup A are both important constituents of their respective fabric groups, which were commonly used to make the Ahk'utu' vases. The Volcanic Ash Subgroup B is placed under the Volcanic Ash Group. Variation in associated mineralogical composition and texture serves to divide the samples into three subgroups. Subgroups A and B are both characterised by the presence of quartz, biotite, and plagioclase feldspar inclusions, but the temper and inclusions of Subgroup B are finer-grained than Subgroup A (Figure 16.3c). Subgroup C contains only very fine-grained volcanic ash temper and quartz inclusions (Figure 16.3d). Just as Subgroup B, the presence of quartz, biotite, and plagioclase feldspar inclusions in Subgroup A points to the Maya Mountains area as the potential provenance of these vases. Rather the lack of inclusions other than volcanic ash and quartz in Subgroup C has made the determination of the provenance of these samples difficult.

The Crystalline Calcite Subgroup A belongs to the Crystalline Calcite Group. Variation in the texture of calcite inclusions serves to divide the samples into two subgroups. The calcite inclusions of Subgroup A display a wide range of grain size, relative abundance, sorting and shape. The calcite inclusions of Subgroup B appear to be more homogeneous in grain size and sorting, and more angular in shape (Figure 16.3e), implying that the inclusions were likely added as temper and that the ceramic paste was prepared in a more standardised fashion. The vases of the Crystalline Calcite Group were likely produced locally at, or in proximity to, the sites of recovery, given the dominance of crystalline calcite as underlying bedrock in Belize and the ubiquity of calcite ceramic paste recipes in the Maya lowlands during different periods.

There are also a few samples that were made using the fabric of the Mixed Carbonate Group, even though the occurrence of this fabric has yet to be characterized among the Pacbitun samples. This fabric is characterized by the presence of crystalline and micritic calcite as the principle types of inclusions (Figure 16.3f). Both types of calcite inclusions display a great degree of homogeneity in grain size, sorting, and shape. The identification of micritic calcite points to northern Belize, which is underlain by micritic calcite deposits of New Town Formation and Orange Walk Group, as potential provenance of these vases.

Forming

Moulding is believed to have been used to build the vases, although clear physical evidence for this method is at times wanting. Yet, this hypothesis is made on the basis of the recovery of ceramic moulds depicting the standard iconography of Pabellon vases, as well as moulds of other moulded-carved vases, including that of Actun Xtuyul (see Spenard and Helmke 2020). Furthermore, the seams for the two halves of the vases are visible in the vertical plain bands that separate the iconographic scenes, along which the vases also preferentially fracture. Building on observations and measurements made by Helmke, while studying the Ahk'utu' vases from various sites across the eastern lowlands, he further suggested that several generations of moulds might have been used in forming and replicating the designs of the vases, resulting in an overall decrease in the size of vases and their iconographic and glyphic decorations over time.

Surface Finishing

Slipping and gouging-incising were the principal mode of surface finishing techniques used in decorating the vases, but the order of slipping and carving was not the same across the calcite and volcanic ash vases. Although the exterior surface of the Pacbitun samples that were submitted for this study was too corroded for the assessment of surface finishing techniques, based on previous characterizations, the calcite vases were slipped first before carving, as reflected in the lack of remnants of slip in the troughs of carving lines. The order of slipping and carving was

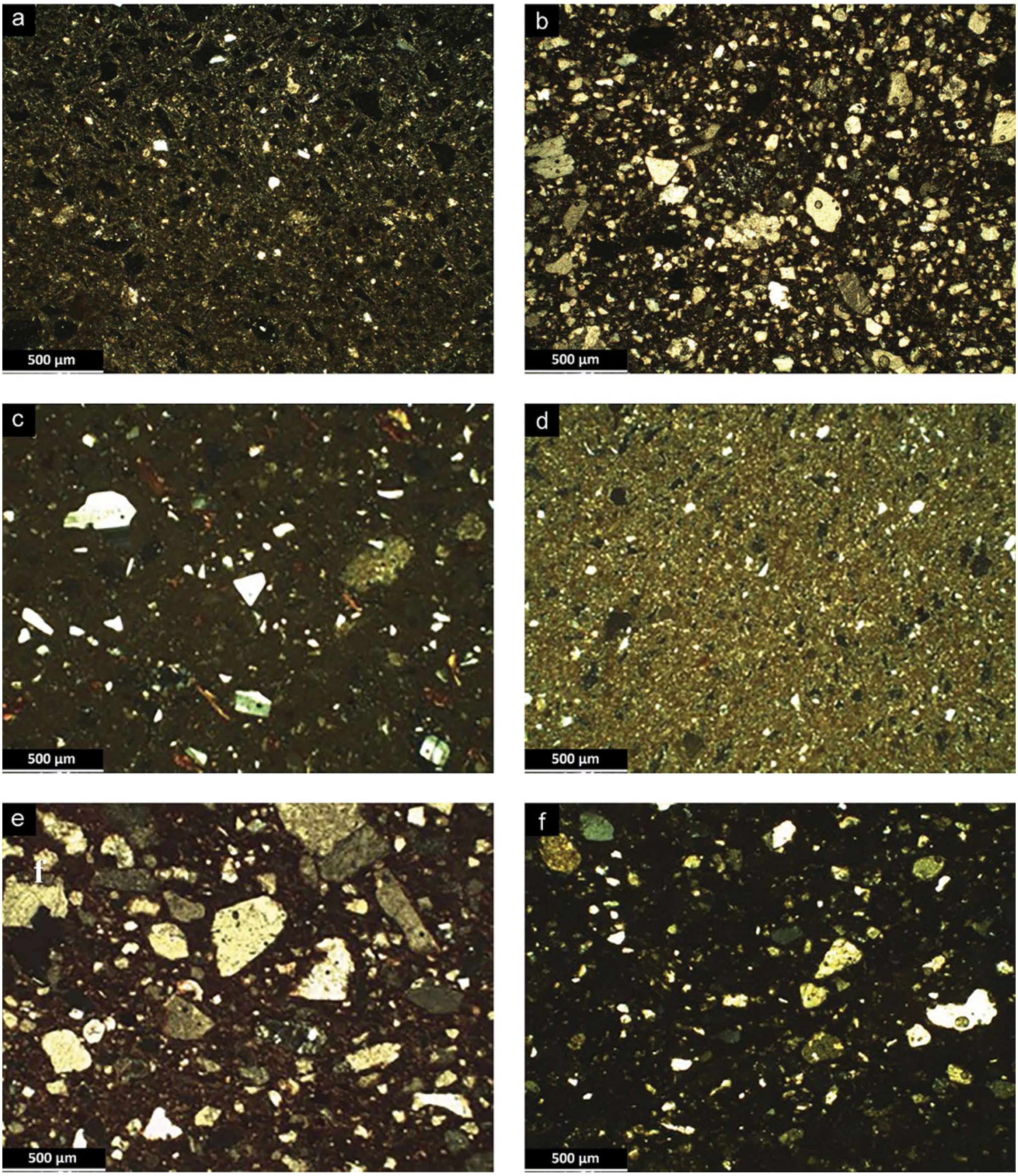

Figure 16.3. Photomicrographs showing the fabric of a) Volcanic Ash Subgroup B, b) Crystalline Calcite Subgroup A, c) Volcanic Ash Subgroup A, d) Volcanic Ash Subgroup C, e) Crystalline Calcite Subgroup B, and f) Mixed Carbonate Group. The photomicrographs of the Volcanic Ash Subgroup B and Crystalline Calcite Subgroup A were taken from the Pacbitun samples, whereas the photomicrographs of the remaining subgroups were taken from other Ahk'utu' samples. All photomicrographs were taken in XP at ×50 magnification. Field view=3mm.

reversed for the volcanic ash vases. Nonetheless, in both cases of the calcite and volcanic ash vases, the slips were made with the same clays as the ones used for the ceramic paste. The results of SEM-EDS analysis confirm that only slight variation exists in the composition of the slip and associated ceramic body, but the FeO concentration of the slip is significantly higher, which was brought about by the addition of iron oxide to enhance the redness of the fired slip.

Firing

The vases were fired in different atmospheres and at different temperatures. The calcite vases were likely fired in varying redox atmospheres, ranging from incomplete oxidation to reduction, as evident in the presence of a dark firing core and dull paste colour. The firing temperature of the calcite vases is lower than 750° C, judging from the absence of signs of vitrification revealed by the SEM. On the other hand, the bright and homogenous paste colour of the volcanic ash vases suggest that these vessels were fired in a complete localized atmosphere. The firing temperature of these vases is likely to be slightly higher than the calcite ones, resulting in the occurrence of localized processes of vitrification, especially in areas around the volcanic ash temper. That said, the volcanic ash vases could not have been fired at temperatures above 800° C as the rest of the clay matrix remained largely flaky.

Specimen Descriptions

The ceramic attributes of the Pacbitun sherds are described below. The specimens are grouped by context (Table 16.3) and—where possible—by ware, and additional attributes are described in detail. The structure of data presentation duplicates that adhered to in the description of the Altun Ha moulded-carved collection (Helmke 1999b). Terminology and detail of the descriptions are a combination of those employed by Gifford (1976) and Pendergast (1971).

Provenience:	Pacbitun Structure NW 42, Burial 1, Lot 415
Reference:	Campbell-Trithart 1990:357, 376
Type:	Ahk'utu' Moulded-carved
Variety:	Unspecified
Group:	Unspecified
Ware:	British Honduras Ash Ware
Complex:	Spanish Lookout, Late Facet
Sphere:	Tepeu 3
Sherds:	29
Illustration:	Figures 16.4, 16.5, 16.6, 16.7a-e

Form: Cylindrical to barrel-shaped body profile, medium thick sides; slightly constricting orifice; rim rounded and slightly incurving; base and majority of body not recovered; tripod supports are associated with examples recovered from other sites. These are hollow oven feet with ceramic rattler balls.

Size: Rim diameter has been reconstructed as 11.20 cm. Thickness of the walls ranges between 0.60 cm and 0.65 cm. Relief of carving of the decorative scenes ranges between 0.10 cm (incised details) and 0.25 cm (gouged/excised backgrounds).The height of the superior moulding is 4.83 cm (its ridge measures between 0.53 and 0.60 cm high); the medial moulding is 1.45 cm high (its ridge is 0.55 cm high). Although a representative portion of the basal moulding did not preserve on any sherd, one does represent part of the ridge of the basal moulding. Based on this sherd the ridge was determined to be 0.45 cm high. The height of glyph band is 2.55 cm and the width of the plain band separating the iconographic scenes is slightly in excess of 2.00 cm.

Surface

Exterior: Iconographic and epigraphic elements are rendered in very fine lines. The excellence of this specimen is paralleled only by the Ucanal vase (see Helmke and Reent-Budet 2008: Figure 1) in terms of execution of the design and the viability of the glyphic collocations. Weathering is moderate and even over the exterior surface, due to paste composition. Portions where the slip has spalled off have eroded considerably more than adjacent slipped portions. The exterior was slipped, but only small patches remain. The slip is easily scratched and relatively thin. Slip has a low lustre and does not appear to have been applied evenly.

Interior: The interior is extensively weathered. No evidence of slip remains, but discoloured patches suggest that the interior surface may have been coated with a thin wash of comparable colour to that of the slip applied on the exterior.

Paste: The paste is very soft, very fine-textured, and oxidised throughout. The paste cross-section and parts exposed on the exterior and interior surfaces display a low ratio of inclusions to matrix.

Table 16.3. Distribution of Ahk'utu' Moulded-carved ceramics at Pacbitun found prior to the 2006 field season.

Structure	Level	Lot/Op. no.	Freq.	Reference	Described	Illustrated
Site Core:						
Stela 2	Level 1	Op. 2	1	Healy 1985: 26–27, Fig. 12d	Y	Y*
Stela 8	Level 1	Lot 194	1	Sunahara pers. comm. 1999	Y	Y
Str. 23	Level 1	Lot 13	1	Bill 1987: 9, 139	Y	Y
Settlement/Periphery:						
NW Str. 42	Burial 1	Lot 415	>29	Campbell-Trithart 1990: 357	Y	Y
SE Str. 6	Level 1	Lot 301	1	Campbell-Trithart 1990: 376	Y	Y
SW Str. 60	Level 1	Lot 401	1	Sunahara 1994: Fig. C.12a	Y	Y

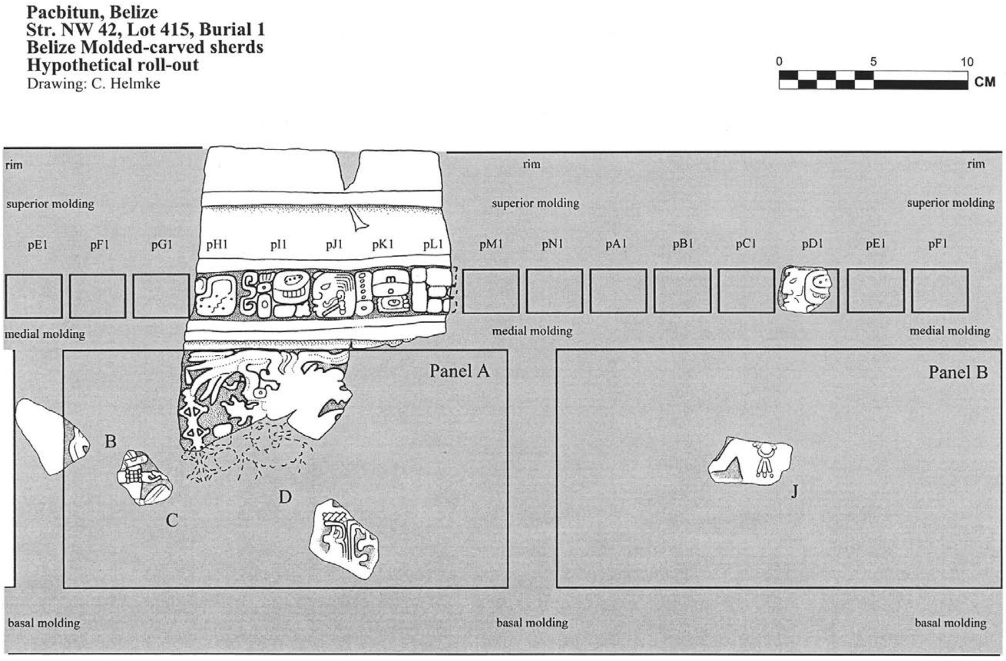

Figure 16.4. Hypothetical roll-out of Vase 415/1 (drawing by Christophe Helmke).

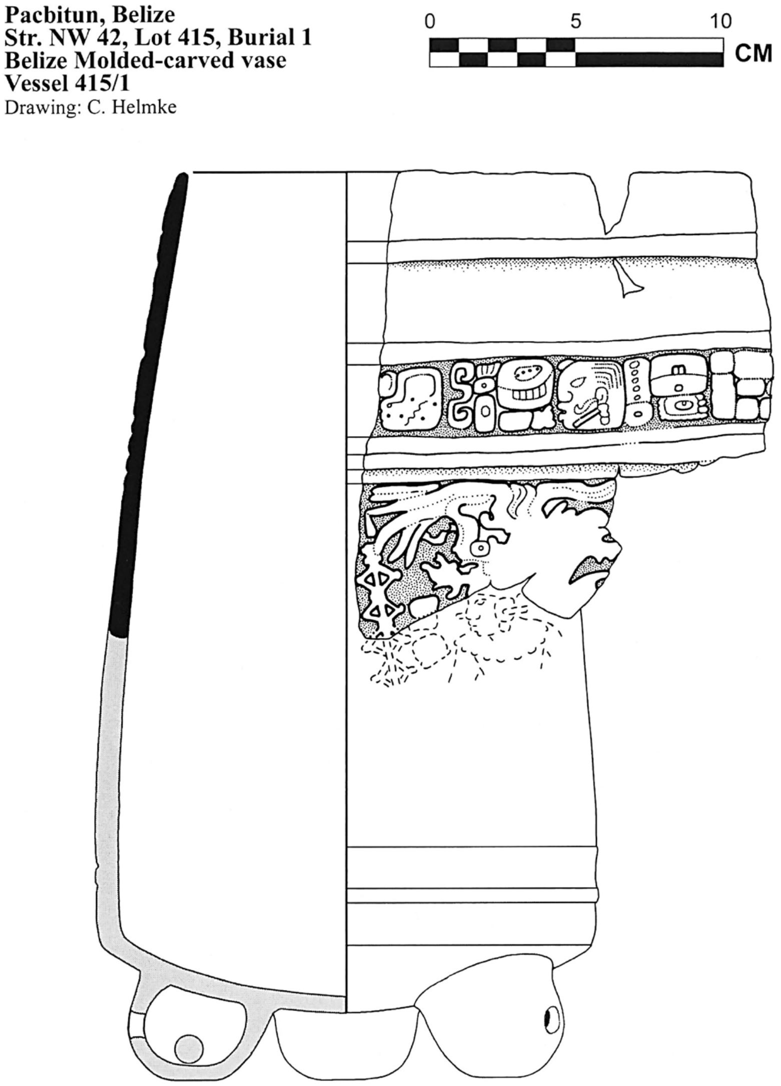

Figure 16.5. Reconstruction drawing of Vase 415/1 (drawing by Christophe Helmke).

Temper: All inclusions visible are very small. None exceed 0.40 cm in diameter. Calcite grains and flecks are present but are very few in number and measure less than 0.40 cm in diameter (n= 9). Paste was examined at ×7 magnification, which revealed minute to very small inclusions in the cross-section of the vase. Salient among these is a laminar-tabular fragment of a layered rock of sedimentary origin, but possibly schist or shale. The paste is otherwise predominantly composed of finely ground volcanic tuff or pumice mixed in the clay paste.

Colour: Paste is yellow to buff coloured. Areas of the carved decorative panels on the exterior that were over-exposed during the firing process have turned a tan to beige colour. The slip is orange. The possible wash on the interior appears to have been light orange (i.e., diluted colour of the slip).

Decoration: The fragmentary vase represents part of the hieroglyphic text that are typical of Ahk'utu' Moulded-carved vases. The decorative panels represent the upper portion of the war staff and the headdress of the Main Figure (Figure D) of Panel A. The miscellaneous sherds that do not conjoin with the large fragment of the vase represent the right hand of Figure B and the head of Figure C in Panel A, the lower backrack of Figure D in Panel A, and the torso of the Main Figure (Figure J) in Panel B. The fragmentary glyphic text represents a portion of the nomino-titular section transcribed as *chowtijatz' ixolom ukawal* (glyph blocks pll-pM1) (see Helmke and Reents-Budet 2008). In addition, one sherd also represents the verbal suffix—*najal* of the surface treatment section (glyph block D1).

In addition to the sherds comprising the partial vase described above, another set that is equally assumed to have been recovered as Lot 415 from Burial 1. This accounts for the total of 86 sherds reported by Campbell-Trithart (1990) and these represent the remains of at least another vase. Based on the elements preserved of the two decorative panels it seems clear that vases represented two different iconographic programmes. Only one sherd of these additional vases bears glyphic data. This collocation does not occur on other known Ahk'utu' vases, which argues against the identification as such and may represent the remains of a Sahcaba Moulded-carved vase (pending re-examination). All these sherds are ash-tempered and represent Vinaceous-Tawny and British Honduras Volcanic Ash Wares. Many sherds depict portions of the non-Caves Branch scenes represented in Lot RP 91/97 of Altun Ha. It should be noted that the iconographic programmes in question may be restricted to particular paste groups as the combination of these two variables is duplicated in the Altun Ha and Pacbitun assemblages. Execution, detail of incised elements, the presence of muscovite mica inclusions is duplicated in the assemblage of both these sites. The extent of variation in paste composition and rendition of iconographic elements falls within the range defined for non-Ahk'utu' sherds of Lot RP 91/97 at Altun Ha.

Provenience:	Pacbitun, Structure 23, Lot 13
Reference:	Bill 1987:9, 139, Appendix II-2
Type:	Ahk'utu' Moulded-carved
Group:	Unspecified
Ware:	British Honduras Ash Ware
Complex:	Spanish Lookout, Late Facet
Sphere:	Tepeu 3
Sherds:	1
Illustration:	Figure 16.7f

Form: Apparently cylindrical vase. Too fragmentary to comment further. Based on the fragment of the iconographic programme represented this sherd was identified as being derived from an Ahk'utu' Moulded-carved vase.

Size: As only one sherd is represented few measurements could be obtained. Thickness is 0.75 cm and relief of carved designs is ranges between 0.1 cm (incised detail) and 0.25 cm (gouged background).

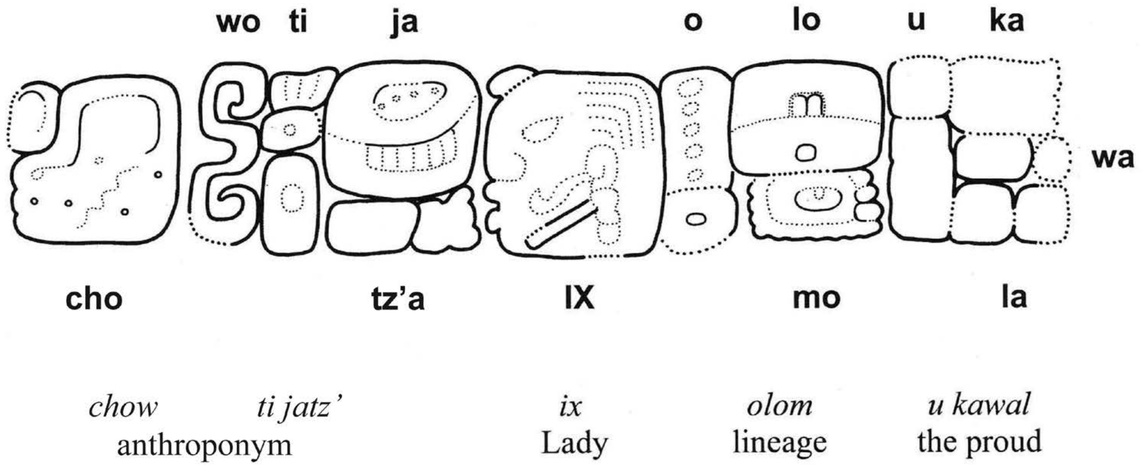

Figure 16.6. The glyph blocks representing part of the nomino-titular section preserved on Vase 415/1 (drawing by Christophe. Helmke).

Surface: The moulded, gouged and incised elements are moderately to severely weathered due to the friable paste. A nearly identical example in terms of execution, paste, and thickness from Altun Ha (Lot RP 1 09) displays a very thin light orange wash (Helmke 1999b). Based on these similarities it is possible that the Pacbitun sherd had also been coated with a thin wash that has since eroded. The incised details can be made out when compared to the better-preserved examples of this portion of the decorative scene from other sites. The interior is heavily eroded and bears no signs of tooling or smoothing marks that are so prevalent on Carbonate Ware sherds of this type.

Paste: The paste is very friable and soft and well oxidised throughout. The paste is very fine-textured and inclusions are few.

Temper: Although minute calcite inclusions are present these represent a very low ratio in comparison to the clay matrix. Indeed, only eleven calcite grains were found during examination of the exposed paste surfaces. Ground pumice or volcanic tuff mixed with a clay matrix constitute the paste. No additional inclusions, besides calcite, were noted.

Colour: The colour of the paste and the base colour is yellow to buff.

Decoration: The sherd represents part of Panel A of the Caves Branch Scenes. Part of a squatting dog (Figure A) and the legs of a standing warrior (Figure B) are all that are represented on this sherd.

Provenience:	Pacbitun, Structure SW 60, Lot 401, Level 1
Reference:	Sunahara 1995: Figure C-12a
Type:	Ahk'utu' Moulded-carved
Group:	Unspecified
Ware:	British Honduras Ash Ware
Complex:	Spanish Lookout, Late Facet
Sphere:	Tepeu 3
Sherds:	1
Illustration:	Figure 17.7g

Form: Apparently cylindrical vase. Too fragmentary to comment further. Based on the fragment of the iconographic programme represented, this sherd was identified as being derived from an Ahk'utu' Moulded-carved vase.

Size: As only one sherd is represented few measurements could be obtained. Height of medial moulding is 1.90 cm, central ridge measures 0.50 cm high. Thickness of sherd and relief of carved designs were unavailable.

Surface: n.d.

Paste: The paste is very friable and soft and well oxidised throughout. The paste is very fine-textured and inclusions are few.

Temper: Although minute calcite inclusions are present these represent a very low ratio in comparison to the clay matrix.

Colour: The colour of the paste and the base colour is yellow to buff.

Decoration: The sherd represents a fragment of the medial moulding and upper right side of Panel B. The portion of the iconographic programme represented shows feathers of the headdresses worn by the Main Figure (Figure J) and the kneeling Figure L.

Comment: The specimen is included among the petrographic samples compiled at the Royal Ontario Museum by Kay Sunahara. Her analyses indicate that this sherd is typical of the British Honduras ash ware. Data are based on information from personal communications with Sunahara (1998) and data presented in Figure C-12a of Sunahara's thesis (1995).

Provenience:	Pacbitun, Structure SE 6, Lot 301, Level 1
Reference:	Campbell-Trithart 1990:376
Type:	Ahk'utu' Moulded-carved
Group:	Unspecified
Ware:	British Honduras Ash Ware?
Complex:	Spanish Lookout, Late Facet
Sphere:	Tepeu 3
Sherds:	1
Illustration:	Figure 16.7h

Form: Apparently cylindrical vase. Too fragmentary to comment further.

Size: As only one sherd is represented few measurements could be obtained. The height of the superior moulding is 1.54 cm (its ridge measures 0.30 cm high). The height of the medial moulding is estimated to be ca. 1.50 cm high. The height of the glyph band is 1.82 cm. Thickness of sherd and relief of carved designs were unavailable.

Surface: n.d.

Paste: n.d. The sherd was originally identified as a Martins Incised sherd (of British Honduras Ash Ware). As such, it is suspected that the sherd is very fine-textured and inclusions are few.

Temper: n.d.

Colour: n.d. It is likely that the paste and the base colour is yellow to buff. No data either on slip or wash colour.

Decoration: The sherd represents part of a glyph block (pD 1) and a fragment of a following glyph block (pEl). A portion of the superior moulding framing the primary glyph band is also present. The syllabic signs of the collocation represent **ja-la**, forming *–jal*. The collocation probably represented the affix *–najal*, which follows the verb for incising, carving or polishing (i.e. *yuxul*). Since moulded-carved specimens are carved, gouged and incised this glyphic collocation may occur in the dedicatory texts of other types of moulded-carved vases. Indeed, examples of *yuxul-najal* pairs have been noted in the dedicatory texts of atypical Ahk'utu' Moulded-carved ceramics in the Altun Ha collection (Helmke 1999b). Consequently, the identity of the Lot 301 specimen cannot be adequately determined at present. The fragment of the following collocation (pEl) represents part of the syllabic sign ya (Tl26). In Ucanal type dedicatory texts the collocation following *najal* is the vessel type glyph, read *yahk'utu'*. Based on the presence of a fragmentary Tl26 at pEl it is possible that the dedicatory text recorded on the Lot 301 sherd is of the Ucanal or Actun Tunichil Mucnal variant.

Comment: This sherd could not be examined in person as it is not in the collections at Trent University. Originally the sherd was identified as a Martins Incised: Martins Variety specimen (Gifford 1976:262, 265, Figure 167a-g). The glyphic collocations represented on Martins Incised sherds are, however, entirely pseudoglyphic which is not the case with the Lot 301 sherd. In addition, the Martins pseudoglyphs are only incised without making

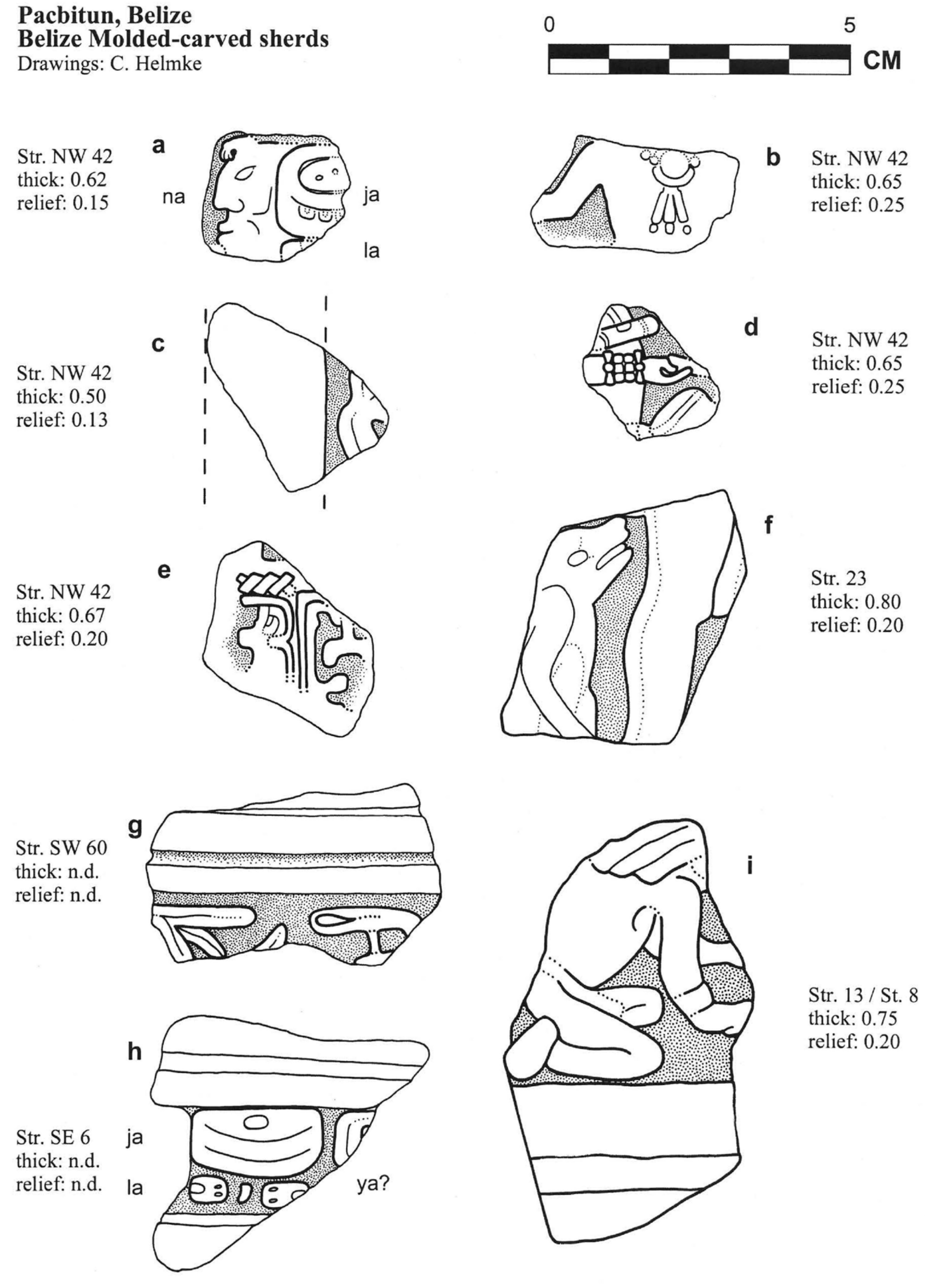

Figure 16.7. Ahk'utu' Moulded-carved sherds from multiple contexts at Pacbitun.

a distinction between foreground and background. The Lot 301 example is noticeably different as it is rendered in low-relief, with a prominent gouged background, with a viable collocation and a superior moulding. Based on these characteristics the sherd is identified as an Ahk'utu' Moulded-carved sherd.

Provenience:	Pacbitun, Structure 13 / Structure 8, Lot 194, Level 1
Reference:	Sunahara personal communication, 1998-1999
Type:	Ahk'utu' Moulded-carved
Group:	Unspecified
Ware:	Mountain Pine Carbonate Ware
Complex:	Spanish Lookout, Late Facet
Sphere:	Tepeu 3
Sherds:	1
Illustration:	Figure 16.7i

Form: Apparently cylindrical vase. Too fragmentary to comment further. Based on the fragment of the iconographic programme represented this sherd was identified as being derived from an Ahk'utu' Moulded-carved vase.

Size: As only one sherd is represented few measurements could be obtained. Thickness ranges between 0.5 and 0.7 cm; relief of carved designs is 0.2 to 0.3 cm. Height of basal moulding is reconstructed as 4.4 cm, the central ridge measuring 0.8 cm high.

Surface: The interior margin of this sherd exhibited voids whose disposition and shape suggest that they exist where calcite inclusions were affected in the firing process. Subsequently soluble temper inclusions may have also been leached out of the sherd after deposition. This makes the vessel sherd generally porous and more structurally fragile.

Paste/Temper: Predominantly composed of moderately sorted medium calcite grains of sub-angular shape composing just less than half (40 %) of visible aplastic inclusions. Quartz is next most abundant inclusion at approximately 15 %, poorly sorted in the petrofabric and of medium grain size and sub-angular shape. Additionally, trace amounts (i.e., < 1 %) of muscovite mica were observed. Poorly sorted and trace amounts of opaque, well-rounded inclusions that may be hematite were also observed.

Colour: n.d.

Decoration: This sherd represents the kneeling captive (Figure I) of Panel B.

Comment: Although this sherd could not be examined in person in October 1999, the sherd is also included among the petrographic samples compiled at the Royal Ontario Museum by Kay Sunahara. Paste and temper data presented above are based on information from personal communications with Sunahara. The drawing of the sherd was produced by the first author at the Royal Ontario Museum in 1998.

Provenience:	Pacbitun, Plaza A, Structure 2, Op. 2, Level 1
Reference:	Healy 1985:26-28, Figure 12d
Type:	Ahk'utu' Moulded-carved (?) / Alt. Sahcaba Moulded-carved
Variety:	Unidentified
Group:	Unspecified
Ware:	Pine Ridge Carbonate?
Complex:	Transitional Spanish Lookout / New Town
Sphere:	Tepeu 3
Sherds:	1

Illustration: Not illustrated in this chapter (see Healy 1985: Figure 12d).

Form: Apparently cylindrical vase. Too fragmentary to comment beyond that. Descriptions of similar vases is provided above.

Size: As only one sherd is represented few measurements could be obtained. Diameter and height unknown. Thickness ranges between 1.0 and 0.8 cm.

Surface: 'Surfaces are carved and smoothed' (Healy 1985:28). Slip is badly eroded and has preserved solely in patches.

Paste/Temper: Soft paste is fine textured and oxidised throughout. Few temper inclusions.

Colour: Slip is light orange. Paste is buff coloured throughout.

Decoration: 'Two carved segments of the decorative panels are represented' (Healy 1985:28). Too few details are present to identify the iconographic programme represented. Apparently, the sherd represents part of the plain band separating two decorative panels.

Comment: Initially this sherd was tentatively identified as Pabellon Moulded-carved (Healy 1985:26), but this identification is no longer tenable.

17

Contextualizing the Archaeology of Pacbitun, Belize: An Epilogue

Arlen F. Chase

Pacbitun today is located ‘off the beaten track,’ tucked into a remote locale abutting the foothills of the Maya Mountains at a distance from major modern population centres. But this site was apparently not isolated in antiquity. The archaeological record of Pacbitun exhibits extensive long-distance trade connections during both the Middle to Late Preclassic eras and, again, during the Terminal Classic period. It was also locally connected to neighbouring sites in Belize throughout its archaeological history. While Pacbitun was the most prominent settlement in its immediate proximity, probably beholden to other polities during most of its history, the real question is how and why this remotely-located site was so interconnected to the rest of the Maya world? We don’t talk much about Maya globalisation, but the archaeological data from Pacbitun make it clear that the centre was never removed from the mainstream of Maya society and, indeed, at some points in its history was exceedingly connected with the rest of the Maya world.

Particularly during the Preclassic period, the site provides an early expression of complex Maya architecture, presumably both in private and public contexts. The earliest architectural complexes at the site date to the Middle Preclassic period (900-300 BC) and consist of what appear to be the outlines of large construction platforms, often only one course high, separated by long narrow alleyways (e.g., see chapter three, this volume; Powis *et al*. 2017). The areal exposures of these architectural features at Pacbitun are fairly unique. Given that similar areal excavations to expose early architecture are not frequently undertaken to the same degree at other Maya sites, it is not clear whether these features exist in a similar form elsewhere. Whatever the case, the earliest Pacbitun platforms, while low-lying, are combined with walkways, suggestive of complex neighbourhood planning. The conjoined platforms and alleyways are a development that does not appear to have survived into later eras. The layout of these early platforms and walkways, albeit at a smaller scale, echoes other Middle Preclassic settlement plans that disappear, such as the early gridded cities of the Maya that also did not survive into the Late Preclassic era (300 BC –AD 250; e.g., A. Chase and D. Chase 2019a). While only a small sample of Middle Preclassic Pacbitun settlement has been excavated, in combination with the more monumental architecture associated with Pacbitun’s Plaza A, it is possible that further excavation may reveal a gridded plan—such as that found at Nix’tun Chich’ in the Peten of Guatemala (Pugh 2019; Pugh and Rice 2017) and associated with other sites both in the Peten (Pugh *et al*. 2019) and in the Tabasco region of Mexico (Inomata *et al*. 2021)—that has been overlain by Late Classic terraforming and construction.

Pacbitun also evinces a precocious development of public architecture co-incident with the development of early E Groups at sites elsewhere in the southern Maya lowlands (Freidel *et al*. 2017). The one structure that has been fully defined on this early level is an impressive northern platform that is some 2 m in height and measures 32.5 m east-west by 20.4 m north-south; it dates to between 600-400 BC and is associated with the initial plaza floor above bedrock within Pacbitun Plaza A (see chapter three, this volume). The use of 3D imagery to show what this building (and others at Pacbitun) looks like is an innovative use of this technology in the Maya area (see chapter seven, this volume). The buried construction in Plaza A is clearly a public building, but what it articulates with is not clear. While we focus on the western pyramid and the long eastern platforms of E Groups (e.g., A. Chase and D. Chase 2017), sometimes these groups are associated with both northern and southern platforms, as can be seen in the early excavations of Group E at Uaxactun, where a northern platform was established at the beginning of that complex’s history conjoined with a slightly later southern platform surmounted by a triadic complex that defined the northern and southern ends of the better understood eastern and western constructions forming Uaxactun’s E Group (Ricketson and Ricketson 1937); similar constructions associated with E Groups have also been recorded at a series of sites in the central part of the Yucatan Peninsula by Ruppert and Dennison (1943; see also Hansen 1992). Therefore, it is imperative that the relationship of this early northern platform to any constructions underlying the eastern and western buildings in Pacbitun Plaza A be determined in future work.

In its present form, Pacbitun Plaza A constitutes an eastern triadic complex, which served as both an ancestral shrine and a ritual locus. Eastern triadic complexes are the Belize Valley variants of E Group complexes (Awe *et al*. 2017; A. Chase *et al*. 2014; Micheletti 2016; see also chapter 5, this volume). This is indicated both by the fact that there is no common platform for the three eastern buildings and by the extensive sequence of burials within the eastern constructions that span the entire Classic period, including the Late Classic period (see chapter two, this volume; Healy 1990a; Healy *et al*. 2004), something not found in traditional E Groups (Chase and Chase 1995; Laporte and Fialko 1995) but that is in evidence in the well-excavated eastern buildings in the eastern triadic complexes associated with the main plazas at Chan (Robin 2017) and Cahal Pech (Awe 2013). While originally established as important public buildings associated with solar observation by independent communities, the function of the eastern triadic complexes of the Belize Valley changed over time; as these smaller centres were incorporated into larger political units and communities lost some of their more overarching ritual activities, these eastern triadic complexes became venues for the placement of important local dead.

Besides the construction of monumental architecture during the Preclassic period at Pacbitun, the site was engaged in the production of beads made from marine shell as well as the procurement of massive amounts of *jute*, ostensibly for culinary purposes (see chapter four, this volume; Healy *et al*. 1990). These marine beads and debitage occur in the fills of Pacbitun's early platforms and on the surface floors of these structures, indicative of both use and manufacturing debris; the debris is also associated with chert micro-drills that are reflective of the manufacturing process (Healy *et al*. 2014; Hohmann 2014). The amount of marine shell associated with the early platforms of Pacbitun is reflective of its inter-connectivity with the rest of the Maya world during the Middle and Late Preclassic periods and of the extensiveness of early trade in these items. This trade also included grouper and parrot fish from the Caribbean Sea (see chapter four, this volume), something also recorded for Caracol (Teeter and Chase 2004). Of even more interest is the incorporation of *jute* shells into the fills of early platforms. While *jute* can be a subsistence item (Healy *et al*. 1990), the inclusion of tens of thousands of these shells in the central fills of Pacbitun can also be interpreted as symbolically representing the underworld, in much the same way as the incorporation of massive amounts of greenstones in the fills of La Venta, Mexico (Drucker *et al*. 1955). Thus, the earliest construction fills at Pacbitun could possibly be interpreted as a conscious attempt to create a cosmological version of the Maya world where the massive amount of shell in the platform fills symbolically represented the lower level of the Maya world.

Late Classic period Pacbitun (AD 550 – 800) appears to be a production locale for slate, granite, musical instruments, and perhaps some kinds of crops as reflected in the proliferation of Late Classic agricultural terraces. Slate, presumably because of its black colour, was utilised in ancient Maya ritual. Healy and his colleagues (1995) have noted that at least 45 locations existed at Pacbitun that incorporated slate into the archaeological record. He noted a source for slate not far from the site. Larger pieces of slate were used for burial linings and capstones. Smaller pieces of slate formed the backs of hematite mirrors. Further south of Pacbitun, at Caracol, slate was used for tomb and burial capstones, for carved hieroglyphic monuments, for mirror backs, and for smaller objects like pendants and drills (associated with shell working); smaller chips of slate were also incorporated into many of the site's ritual deposits. While Pacbitun did not provide slate to Caracol, it may well have provided it to other sites in the Belize Valley. Slate is noted as having been worked at Xunantunich (Braswell 2010) and it is likely that the material found there ultimately derived from Pacbitun. The evidence for granite production at Pacbitun was found in residential groups of Late Classic date where preforms for manos were recovered (see chapter fourteen, this volume). The mano preforms were found on the west side of the site even though sources of granite were located only to the east (see chapter fifteen, this volume). Another case of granite preform production, this time for metates, has been reported for the banks of the Macal River (now under water) east of Caracol (A. Chase *et al*. 2014:8680).

One of the unusual things about Pacbitun is the large number of musical instruments that have been recovered in burials at the centre. These were initially reported by Healy (1988; Healy *et al*. 2008) and newer finds are reported by Cheong (see chapter eight, this volume). All of these instruments date to the Late Classic period. Some of the inhabitants of Pacbitun must have been musicians and these instruments were likely utilised for rituals and highly prized. Their longevity is indicated by the wear and tear on some of these pottery items. Whether or not they were actually manufactured at Pacbitun is an open question, but the centre is certainly unusual in terms of the quantity of fine whistles, flutes, and ocarinas recovered in the course of archaeological research there. The twelve wind instruments recovered in Burial 2 (Pacbitun's eastern court) suggest a potential death ritual involving multiple musicians or, alternatively, the prized possessions of a musician. Because some of these instruments were older than others, it may be that the latter interpretation is correct. The number of musical instruments recovered in Pacbitun's Late Classic interments strongly suggests that there was a focus by the centre's inhabitants on the production of music. It is not so far-fetched to suppose that there were even traveling troupes of very experienced musicians from Pacbitun that went to other coterminous Belize Valley centres to actively participate in a variety of ceremonies.

One of the architectural features that initially drew Healy to Pacbitun was the site's agricultural terraces, features that he was involved in investigating throughout the Maya Mountain area (Healy *et al*. 1980; Healy *et al*. 1983). These are similar to others reported for Caracol (A. Chase and D. Chase 1996, 1998) and for the Belize Valley (e.g., Chan [Wyatt 2012] and the Xunantunich area [Neff 2010]). They are not as extensive at Pacbitun as they are at Caracol, but their presence indicates that crops were intensively produced in the area, either in support of the higher level of population around the centre during the Late Classic period or possibly to produce surplus food items that were exported either as trade items to other areas or as tribute to a higher political authority.

The site plan for Pacbitun shows that causeways were integral to the centre. However, the Late Classic causeways at Pacbitun do not seem to have been for the movement of goods in an economic sense, like they were at Caracol (D. Chase and A. Chase 2014; A. Chase *et al*. 2015). Rather, they appear to have been used for ritual or social linkages (see chapter thirteen, this volume). In some ways they are variants of the ritual causeways of Tikal that link various pyramids to the site epicentre (A. Chase and D. Chase 2003). The southwest causeway is perhaps the most interesting, especially as it terminates at a cave located some 2.6 kms distant from the site centre. Investigation of this cave and other caves in the vicinity of Pacbitun has involved the use of digital technologies as well as tests on absorbed residues on recovered cave artefacts (see chapter ten, this volume). Analysis of materials from caves shows the use of pine for rituals (and probably ritual items), as well as the use of different woods in association with different rituals (see chapter eleven, this volume). The analyses of absorbed residues from Pacbitun are intriguing in terms of what they produced (see chapter twelve, this volume). The initial focus was on analysing bone tubes to determine if they had been used as enemas (an idea first promulgated during late 1960s drug culture and espoused by some Mesoamerican researchers, such as Furst and Coe 1977, and sometimes supported by looted [and possibly repainted] pottery materials [e.g., Stross and Kerr 1990]), but the 'results were disappointing.' Instead, the absorbed residues revealed the presence of willow, cacao, vanilla, and *Datura* (morning glory), suggesting the possible use of a psychotropic. *Datura* is a well-known hallucinogen that shows up in the Postclassic murals of Tulum (Miller 1982). Thus, the recovered data from Pacbitun are strongly suggestive of the use of psychotropic plants by practitioners of ancient Maya rituals, a practice that was likely widespread and that spanned the entirety of their existence (Carod-Artal 2015; Dobkin de Rios 1974).

During the early part of the Classic period, Pacbitun saw the erection of carved stone monuments that are indicative of dynastic connections and ties. We often conceive of Maya sites as being independent, self-sustained units (originally augmented by the idea that emblem glyphs equalled polities; see Mathews 1991), but Pacbitun investigations indicate that this was not the case at any point in time. While the centre may have been more important in the earlier part of the Classic period based on its carved monuments, the archaeology at Pacbitun strongly supports the idea that the site was always incorporated into broader political units (see chapter nine, this volume). Thus, the early stone monuments may have provided legitimacy to the Pacbitun elite, but were likely not reflective of rulership. Pacbitun's leaders played important roles in a broader regional economy for an extended period of time—presumably supplying goods like granite, slate, surplus agricultural products, and musical expertise—and wealth was generated as can be seen in their burial practices and accumulation of elite goods. Rather than representing independent rule, Pacbitun's carved stone monuments were more likely a product of accumulated wealth that were permitted in terms of the broader political system in the early part of the site's history. Thus, even though relatively wealthy, Pacbitun should be viewed as a Classic period provincial polity (e.g., LeCount and Yaeger 2010) that needed to meet tribute demands. While an argument has been made for more wealth being expressed in Pacbitun's early Late Classic burials, this may be an artefact of ties provided through political incorporation. There is an argument that there was less wealth in late Late Classic burials at Pacbitun because of a general lack of polychromes; however, Belize Valley ceramics in the Late Classic don't focus on polychromes, but rather on red wares (Belize Red; see A. Chase and D. Chase 2012 and Gifford 1976). Thus, what we may be seeing is a regional cultural expression and not an expression of wealth. In fact, Healy (1990a:252) has noted that the main building in Pacbitun's eastern triadic complex yielded nine burials and nine caches, reporting that 'several of these features of extraordinary nature, with unusually large concentrations of offerings;' indeed, one of the Late Classic caches associated with this building reportedly was associated with approximately 100 Belize Red vessels, surely an expression of wealth – and, participation in the larger Belize Valley 'culture.'

During the Late-to-Terminal Classic period, a series of enclosed courtyards on the southern side of Pacbitun are interpreted as palaces (see chapter six, this volume). Investigations of these buildings first suggested that slate was being manufactured there and excavations within their plazas have recovered a series of intriguing burials and caches, including one in Court 3 that is associated with a smashed Ulúa marble vase and shell atlatl finger-loops similar to those reported by Harrison (1999) for Tikal (also see Moholy-Nagy 2008). Both of these items are indicative of non-Maya foreign ties. That the centre participated in other Terminal Classic (AD 800-900) political relationships can also be seen in the presence of modeled-carved pottery within the archaeological record. While it is true that modeled-carved pottery was utilised by both elite and non-elites during the Terminal Classic era (see chapter sixteen, this volume), this kind of ceramic is more likely to turn up on palace floors and in structures near the site centre rather than in rural areas, as is found at Caracol (A. Chase and D. Chase 2004, 2005, 2019b). However, the distributional meaning of modeled-carved ceramics is not fully understood, although it may have something to do with specific political identities (see Helmke and Reents 2008). What is clear is that modeled-carved ceramics largely, but not completely, replaced Late Classic polychrome cylinders and bowls in elite contexts. During the Terminal Classic period there were also privately-focused architectural groups at Pacbitun; the acropolis group associated with Structure 33 appears similar in form to the privately-focused Northwest Acropolis at Caracol (which did not have direct frontal entry). Thus, as occurred at Caracol (A. Chase and D. Chase 2009; D. Chase and A. Chase 2017), there is also a suggestion at Pacbitun that there was a growing gap between elite and other members of society during the Terminal Classic period.

Archaeological data from Pacbitun gives insight into the nature of Late Classic political organisation within the Belize Valley (see chapter nine, this volume). The valley is dotted with a series of smaller centres that are fairly regularly spaced and none of them shows any evidence of having ever been a primate centre (e.g., Chase and Garber 2004). Pacbitun is one of these small nodes. While Pacbitun may have had an independent streak during the early part of the Classic period, especially when Caracol directly impacted the valley because of its conquest of Tikal, Guatemala in AD 562 and Naranjo, Guatemala in AD 631, with the ascendance of Naranjo in AD 680 this situation would have changed. The major sites in the Belize Valley, presumably Buenavista and Xunantunich, were both provincial polities of Naranjo after AD 680. Thus, it would appear that Late Classic Pacbitun would have been one of the independent or dependent allies of either one or both of these provincial polities, depending on the broader political picture in the southern Maya lowlands at any point in time. Thus, the intensification of economic production, as revealed through the production of slate, granite, and possibly agricultural terracing, can be interpreted as being related to tribute demands. Within this scenario, the archaeological data from Pacbitun significantly contributes to our overall understanding of the long-term development and maintenance of relationships for a secondary Maya centre that continued to negotiate its political existence following its extraordinary early florescence. Based on the heterogeneous variety of economic items on which Pacbitun's inhabitants focused over the course of the centre's history—shell, slate, granite, agricultural products, musical expertise—it is clear that the inhabitants of Pacbitun successfully navigated a constantly changing and politically volatile landscape throughout most of their history. However, by the onset of the tenth century Pacbitun found itself embroiled in events that had overwhelmed almost the whole of the southern Maya lowlands and that could no longer be functionally negotiated.

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Professor John S. Henderson, Cornell University

'The quality and range of work presented here is impressive.'
Dr Gabriel Wrobel, Michigan State University

This volume presents the results of 35 years of archaeological research at the Maya site of Pacbitun, located in west central Belize. The site was continuously occupied from 900 BC to AD 800/900. Excavations focused on both the site core and periphery, with investigations centred around housemounds, workshops, causeways, caves, and other karst features. In the site core, areas excavated ranged from small domestic houses dating to the Middle Preclassic to large ceremonial architecture (e.g. courtyards, palaces, temples) and complexes (e.g. E Groups) dating to the Late/Terminal Classic periods. From a material culture perspective, extensive research was conducted on ancient Maya use of plants, animals, ground stone tools, musical instruments, and ceramics. Tying all these aspects together, the project has routinely utilised spatial technologies and 3D modelling (aerial and terrestrial LiDAR, photogrammetry) that help to capture the research efforts, from architecture to material remains, over the long-term.

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